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FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

Official Organ of the Royal Aero Club First Aeronautical Weekly in the World Founded 1909

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Welcome Sir Tom

IT is appropriate that the new Chief of the Air Staff, Air Chief Marshal Sir Thomas Pike, should take over at the beginning of a new decade. The fifties have been a great period for the RAF. It celebrated its 40th birthday, established the V-force in Bomber Command, assumed responsibility for UK missile defence, retained control of Coastal Command and now has a new group in Transport Command with specialist responsibility for tactical airborne support operations. Sir Thomas therefore inherits a force with high commitments, but with correspondingly high morale.

Resolved . . .

JANUARY 12, 1866. Argyll Lodge, Campden Hill, London. His Grace the Duke of Argyll presiding. Also present, Mr. James Glaisher, Dr. Hugh W. Diamond, Mr. F. H. Wenham, Mr. James Wm. Butler and Mr. F. W. Brearey. Resolved: ". . . that it is desirable to form a Society for the purpose of increasing by experiments our knowledge of Aeronautics . . ."

The names of those present mean little to the aeronautical community today—far less, in any case, than their attainments merit. His Grace appears in the reference books as a churchman and savant; yet in the very year of that January meeting on Campden Hill he published a philosophical work entitled *The Reign of Law*, which contained this passage: "Yet there is a real impediment in the way of man navigating the air, and that is the excessive weight of the only great mechanical moving powers hitherto placed at his disposal." A nice piece of philosophy for the 1860s. As for Mr Glaisher, it was he who, with Mr Coxwell, went up in a balloon to an altitude that could have been anything between 20,000 and 30,000 feet, possibly more. A nice piece of aerostation for the 1860s.

These, then, were the kind of men who got the Royal Aeronautical Society (patron Her Majesty the Queen) off to its unroyal start. The Society has ever reconciled the dignity of its status with the warmth of companionable discussion. The volumes of its *Journals* preserve historic writings by many of the greatest figures in British aeronautics; yet there is no dustiness or mustiness either about the Society itself or the people who conduct its business—a state of affairs the continuity of which will doubtless be assured by the Graduates' and Students' Section, the Astronautics and Guided Flight Section and, now, the Rotorcraft Section.

But though His Grace the Duke of Argyll (churchman, savant, and dreamer-about-aero-engines) might regard the recent formation of an Historical Section with churchmanly benevolence, he would, we believe, raise an ecclesiastical eyebrow on learning that in recent weeks the Society formed a section devoted to the study of manpowered flight.

All of which may seem a trifle inconsequential in a world transfigured by flying and with Britain's own aircraft industry in the pangs of a rebirth. But it is to this Royal institution that that same industry is vastly indebted—not so much for the enshrining of the industry's achievements as by the encouragement and stimulus afforded by its own proceedings. When these discontinue something cataclysmic will have happened to the industry. So, on the occasion of the celebrations recorded overleaf, the toast is "The Society."

FROM ALL QUARTERS

Major Merger

LAST Tuesday, January 12, the three largest remaining "unamalgamated" members of the British aircraft industry announced their decision to merge. Long predicted, the move completes the major rationalization of the industry which Duncan Sandys, Minister of Aviation, has so strongly urged. The following is a slightly abbreviated form of the official announcement:—

"Vickers, English Electric and Bristol Aeroplane have decided to amalgamate their aircraft and guided-weapon companies. For this purpose they will form a new company [not yet named—Ed.], which will have three wholly owned subsidiaries: Vickers-Armstrongs (Aircraft), English Electric Aviation, and Bristol Aircraft. The shares of the joint company will be held by the principal companies in the following proportions: Vickers 40 per cent, English Electric 40 per cent and Bristol Aeroplane 20 per cent. The financial adjustments required have been agreed; they will involve no new issue of share capital.

"Bristol's helicopter interests will not be included in the merger. Financial responsibility for types of aircraft and missiles already in production will remain with the appropriate principal company.

"The board of the new company will control policy. Directors from the three principal companies and from the three subsidiaries will be on this board. Day-to-day operational responsibility will be exercised through the three subsidiary companies, which will retain their own names and identities. The Minister of Aviation has been fully consulted; it is understood that he welcomes the proposed amalgamation and that he would regard the new company as constituting one of the major aviation groups which would qualify for Government support.

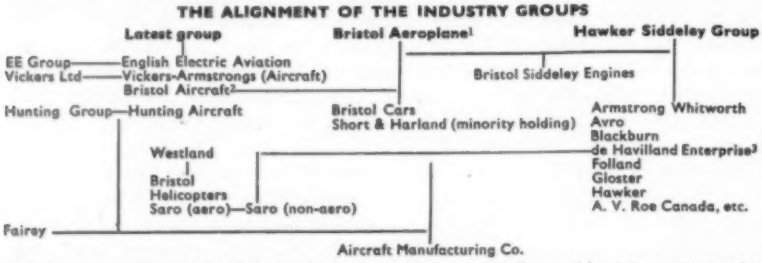
"Vickers, English Electric and Bristol Aeroplane further announce that negotiations are taking place with the Hunting Group with a view to their aircraft design and manufacturing company, Hunting Aircraft, participating in the new company announced above."

A concurrent announcement gave news of the plans for Bristol's helicopter interests. Their directors and those of Westland Aircraft had "reached agreement in principle for the sale of Bristol's helicopter activities to Westland." The financial details of this agreement are that Westland would issue to Bristol 2m Westland shares of 5s each, and approximately £1m in cash, to be paid in instalments as the proceeds of certain contracts to be taken over by Westland were received.

The Bristol-Westland announcement added that the two companies had previously consulted with the Minister of Aviation, who "assured them that he welcomed these new arrangements, which were in full accord with the Government's policy of concentrating the resources of the aircraft industry."

Total work-force in the British airframe and aero-engine industry is approximately 245,000. Precise figures for individual firms are classified by the Ministry of Aviation but it is possible to estimate the totals for the Hawker Siddeley Group (UK aircraft firms) and the new group as approximately 38,000 and 35,000 respectively. The family tree above shows the approximate manner in which the various alliances are ranged.

THE ALIGNMENT OF THE INDUSTRY GROUPS



Notes: this family tree includes only firms which are part of a commercial alliance with one or more companies in the aviation business; 1, now only a holding company, owning no manufacturing potential as such; 2, includes Bristol guided weapons; 3, includes D.H. Aircraft, Engines, Propellers and D.H. Canada (D.H. Aircraft, Fairey Aviation and Hunting Aircraft are partners in the Aircraft Manufacturing Co.).

RAeS Anniversary Luncheon

MORE than 400 members and guests of the Royal Aeronautical Society heard the guest of honour, Duncan Sandys, Minister of Aviation, reply to the toast "British Aviation" proposed by the president, Peter G. Masefield, at a luncheon in London on January 12. The luncheon was given by the president and council on the occasion of the 94th anniversary of the founding of the Society (as the Aëronautical Society of Great Britain, on January 12, 1866) and to celebrate the jubilee of what the RAeS terms the "golden year of British aviation, 1910." The year 1910, the Society feels, is significant in British aviation history because it was that year which saw the real beginning of the British aviation industry, with British pilots flying British-designed and -built aeroplanes, engines and equipment.

Guests at the anniversary luncheon included, as well as Ministers of the Crown and leaders of industry, several pioneers such as Brig-Gen Sir H. Osborne Mance, who has been a member of the Society since 1899, Dr A. P. Thurston, who worked with Sir Hiram Maxim in 1902 and has been a member since 1908, and (it need hardly be added) Lord Brabazon of Tara, a member since 1909.

Mr Masefield read messages from the Society's patron, H.M. the Queen, and from the IAS, CAI, AFITA, and the Aeronautical Society of India. He believed that 1960 would prove to have been as great a year as was 1910—"the golden year of British aviation." Alluding to the Society's new lecture hall, he said that there were already a hundred bookings for meetings. Recent events, he added, gave cause for encouragement, and he was confident that we could leave the future in the hands of Mr Sandys.

Mr Sandys made no direct allusions to mergers but remarked that today the Government was putting £300m a year into various aspects of aviation. His White Paper had been exaggerated in many quarters, but other powers were now having to take the same decisions. Now that military expenditure was being reduced there was a cause for more assistance on the civil side. He estimated that this would be forthcoming. In the 1970s, he said, we could look for commercial speeds of two to three times the speed of sound; though the cost would be heavy, it would be largely off-set by frequency: one supersonic airliner carrying a hundred people across the Atlantic in two to three hours and making a thousand crossings a year would have the same capacity as the *Queen Elizabeth*.

Part I of a historical review of the RAeS as reflected in the pages of its *Journal* appears on pages 69-71 of this issue.

On the Bristol 188

INFORMATION about the structure and systems of the Bristol 188 supersonic research aircraft has so far been severely restricted, but it is now known that companies of the Dowty Group are supplying a considerable amount of equipment. The undercarriage, for example, is built by British Messier Ltd. The exceptionally high temperatures at which this stainless-steel aircraft is intended to operate necessitate extensive use of steel in the landing gear instead of the more usual light alloys, and special test rigs were built to meet the problems involved.

The hydraulic system consists mainly of components made by Dowty Equipment and British Messier, and certain of the Dowty items incorporate the Moog valve, a miniaturized valve designed for use in adverse environments, e.g., in missiles. In the powerplant, Rotol Ltd are "represented by several important ancillary units," but no details are yet available.

The configuration of the 188 was analysed in an article in *Flight* for December 11 last.

***YOUTHFUL INTEREST** in a model of the Institute of Aviation Medicine's man-carrying centrifuge was displayed at the Royal Society of Arts on January 7. The occasion was an excellent RAeS young people's lecture on "Flying versus the Human Machine," by Dr G. Melvill Jones. RAeS president Peter Masefield (with badge) stands next to the lecturer*

SWEDISH MAIDEN: First flight of the J35C Draken (see news-item below) was made on December 30 by Saab test pilot K. E. Fernberg

Tyne Certificated

IT was announced last week by Rolls-Royce Ltd that the Air Registration Board have given full normal-category approval for civil operation to the Tyne RTy. 1 Mk 506, and RTy. 11 Mk 512. The respective ratings are 4,985 e.h.p. average (4,320 s.h.p. plus 1,210lb guaranteed minimum) and 5,545 e.h.p. average (4,850 s.h.p. plus 1,235lb guaranteed minimum).

Production Tynes are now being delivered to Vickers for installation in Vanguards of BEA and TCA. ARB approval follows a combined UK/US type-test completed last June. So far 11,500hr have been logged on the bench and 6,500 in the air. Tynes are also specified for the Canadair 44, Short Britannic 3, Fairey Rotodyne, Bréguet 1150 and Transall C.160.

Sir George Edwards Honoured

DESCRIBED in the citation as "internationally known as one of the world's foremost aircraft designers and aircraft industry administrators," Sir George Edwards, managing director of Vickers-Armstrongs (Aircraft) Ltd, has been awarded the Daniel Guggenheim Medal for 1959. He is to receive it at the annual aeronautics meeting of the Society of Automotive Engineers in New York on April 7.

The medal, given annually "for notable achievements in the advancement of aeronautics," is one of the most coveted honours in the aviation world. The citation announcing its award to Sir George speaks of "a lifetime devoted to the design of military and commercial aircraft, culminating in the successful introduction into world-wide commercial service of the first turbine-powered propeller-driven aircraft."

Sir George joined Vickers-Armstrongs at Weybridge in 1935 and was appointed chief designer in 1945. Under his leadership Weybridge has produced a long line of successful aircraft, including the Valiant and the best-selling Viscount, and is now busy with the Vanguard, VC10 and TSR.2.

Franco/USA Engine Agreement

TWO of the world's leading engine manufacturers, the French nationalized SNECMA group and the Pratt and Whitney Aircraft Division of United Aircraft Corp, have joined forces in a "far-reaching licensing and stock-acquisition arrangement." Under the terms of the contract United Aircraft will acquire a 10 per cent interest in SNECMA and will be represented on that company's board of directors; in return SNECMA are licensed to manufacture and sell all versions of the JT3C, JT3D, JT4A, JTF10A and JT12A, together with all Pratt and Whitney piston engines and their spares.

Draken for Two

LIKE most modern supersonic single-seaters, the Saab-35 Draken has now been produced with two seats for conversion training. Designated J35C by the Swedish Air Force, it differs from the current J35A fighter in having a new forward fuselage with tandem cockpits each provided with a Saab ejection seat and a complete set of controls. Normally the rear seat will be occupied by an instructor whose vision is improved by being seated at a higher level. A single large clamshell covers both cockpits. As in the Gnat Trainer the instructor is protected by a separate windscreen following jettisoning of the canopy.

Most of the additional space occupied by the second cockpit has been made available by simplification and re-location of various items of equipment. Performance is only very slightly affected, the powerplant remaining an SFA-built Avon with afterburner. Series production is now in hand and deliveries to a centralized type-training school will begin this year. At the latter establishment the Swedish Air Force will instruct pupils in Draken handling under all operational conditions using J35Cs in conjunction with a Curtiss-Wright simulator.

FAA Criticize Decca

IN the System Survey page of this issue (p. 84) is a note on advance statements issued by the US Federal Aviation Agency from an as yet unpublished report on American Decca Navigator trials. Since that particular page went to press further information has become available; it now appears that the statements referred to a series of flights made with the FAA Convair C-131 equipped with a Decca Mk 10 receiver.

The FAA alleges that during 22 per cent of the flights the Decca controls were "relatively cumbersome" to manipulate and that the Flight Log pen was subject to deviations which resulted in incorrect navigational information. The Convair was flown, presumably repeatedly, over four "carefully selected routes which presented most of the navigational problems normally encountered." On 61 per cent of these, says the statement, "pilots reported failure of the equipment to provide the necessary navigation intelligence to use the system continuously as a primary instrument flight navigation aid." Decca, it is said, did not fulfil requirements of an aircraft steering device because pilots were unable to maintain a constant heading or change to a new course without the aid of other instruments.

Without more detailed knowledge of the test conditions it is difficult to assess the validity of the criticisms; and many of them in any case appear to be based on the difference between the easily read bearing information derived from VOR and more comprehensive positional information presented on the Flight Log. Whatever the performance achieved, such statements are unspecific and their publication in this way is unscientific if not also unethical.

IN BRIEF

As we go to press we learn of two new Westland helicopters. The Wessex 2 will have two D.H. Gnome engines for increased "hot and high" performance; the prototype should fly this year. The Wiltshire, also to fly this year, will be an anglicized Sikorsky S-61 with twin Gazelles.

A letter of intent for three Westland Westminsters has been placed by the Sardinian airline Linée Aerée Sardé. There are expectations that the final contract will be placed later this month. LAS intends to operate 40/45-seat helicopters over routes between Sardinia, Corsica, the French Riviera, the Italian mainland and Tunis.

The Monte Carlo Rally is being covered by our associated journal *The Autocar* in three special issues. Today's (January 15) describes preparations, with details of routes, cars and drivers; the January 22 and 31 issues will contain full reports respectively of the opening stages and the entire event.

de Havilland Aircraft Proprietary Ltd were due to take over the Government Aero-engine Factory at Lidcombe, Sydney, on January 12. The Australian Minister of Supply, Allen Hulme, said the company would operate the factory as independent contractors and carry out defence as well as commercial work.

Interceptors of the Royal Danish Air Force, including American-built aircraft, are to be fitted with Martin-Baker ejection seats. A spokesman said last week that British equipment had been chosen "because it was considered the most effective available." He added that it was hoped that all RDAF fighters except obsolescent types would be so fitted "in the course of the next year."

The agreement between the French and German Governments to develop the Transall C.160 military transport (*Flight*, November 20, 1959, page 613) has now been signed. Powered by two Rolls-Royce Tynes, the aircraft may later be fitted with a boundary-layer control system (like the C-130B) energized by Bristol Siddeley Orpheus. First flight is scheduled for May or June 1962 and military service for 1965.

Kelvin & Hughes Ltd announce an agreement with the Curtiss-Wright Corporation for exclusive reciprocal rights for the manufacture and sale of equipment for non-destructive testing. The British firm will represent both signatories in the UK, the Commonwealth (except Canada) and Europe; Curtiss-Wright will represent both on the North American continent.

Lockheed Aircraft Corporation has acquired what is described as "an important interest" in the Italian concern Aeronautica Macchi. A joint statement said that ownership of a substantial portion of Macchi stock would provide Lockheed with a strong base in the European Common Market, of which Italy is one of six member countries. Later it was announced that the Lockheed LA-60 Utility Wagon light transport will be built by Macchi under licence.

What Course for the Industry?

No 3 of the series: SIR FREDERICK HANDLEY PAGE interviewed by FRANK BESWICK

SOMEHOW it seemed wrong to put to Sir Frederick Handley Page the question *Do you accept the necessity for an overall contraction of the British aircraft industry?* To one who nurtured its growth right from birth it could seem ironic, to say the least, that after 50 years, when we are at the entrance to the great air age, there should be this talk of contraction. But he put his reply in characteristic perspective:—

"Since World War 2 the industry has been maintained at an exceptionally high level. We could have expected a steady retraction after 1945 but the coming of the jet engine meant a great deal of re-equipment of military forces; Korea kept up demand; and the cold war tension has brought abnormal orders. We are now facing a sudden drop instead of a gradual run-down."

If such a contraction is inevitable ought we to be selective in what we cut down? Or, to put it another way, ought we to decide upon the fields of production in which we can best compete, and concentrate upon them?

"Clearly, the principal contraction must be in manned military aircraft, because of the advent of guided missiles. So we must try to expand the civil side of the business as compensation. The problem is whether we can find an additional civil market to replace the military demands."

Is there any possibility of the civil demand reaching anywhere near the previous military level?

"We must consider how civil aircraft are bought. The number of operators has nothing at all to do with it. It is not a question of BEA, BOAC or the Independents. The passenger pays for the aircraft: a portion of each ticket bought goes towards the cost of a machine, irrespective of who operates it. The number of passengers is what will count, and we must get a hell of a lot more of them. We cannot suddenly get an extra 50 per cent, but to increase at all we need a tremendous energizing force, and the force to which we must turn is the cheap fare. In precisely the same way that we now enjoy summer fruits in mid-winter through refrigeration, we must make it possible for more people to enjoy holidays with sunshine all the year round. At any one time of the year there is sunshine somewhere in the world. By spreading the peak load we can in fact cheapen the holiday. Cheapening the fare, spreading the load (which in turn makes even cheaper fares possible)—that is the way to increase traffic. And that is the way to increase the number of those bits of tickets which will pay for additional aircraft."

Is a supersonic airliner a feasible project for Britain? Have we the resources?

"It is not a question of resources. Nor has it anything at all to do with filling the gap caused by contracting military orders. Obviously it is important from a prestige point of view—just as it is important to win the Ashes. It is important from a research point of view, because so many unknowns might emerge. But it is all a question of priorities. If our immediate priority is to find employment for aircraft workers, if the civil market is to take up the slack, then the important thing is to make subsonic flight cheaper. More research should be directed to that. And that is where the laminar-flow possibility comes in."

Is present State expenditure on research and development adequate to sustain our position? Or could it be more fruitfully deployed?

"The role of The State is to provide facilities for fattening the goose which will lay the golden eggs. The Government must accept responsibility for ordering and paying for prototypes. Of course, some say that this is not a function of the State any more than the ordering and development of, say, steam turbines, and that it ought to be done by private enterprise out of sales revenue. But the fact is that the rate of progress in aviation is so great that we just cannot recoup from sales the money needed for research and development of the magnitude required—not unless we have the certainty of a big market, that is. I know there is a guaranteed home market for the VC10 and D.H.121, but it is a limited market, and many more than these home orders must be sold to break even, let alone pay for future research. Certainly my firm paid the entire cost of the development of the Herald, but that just is not feasible for the bigger transatlantic types. Therefore I say that the Government must return to the policy of ordering prototypes."

When the State provides assistance in that form does it not encourage the firm to take things easier? How can you protect the taxpayer against wasteful expenditure on such prototypes? Is there any new penalty clause which might be inserted in the contracts?

"No additional protection is needed, save for the firm concerned also sinking a proportion of its own money in the project. No private-enterprise company will waste its own money."

If State support of the type indicated is given, do you still consider further rationalization is necessary?

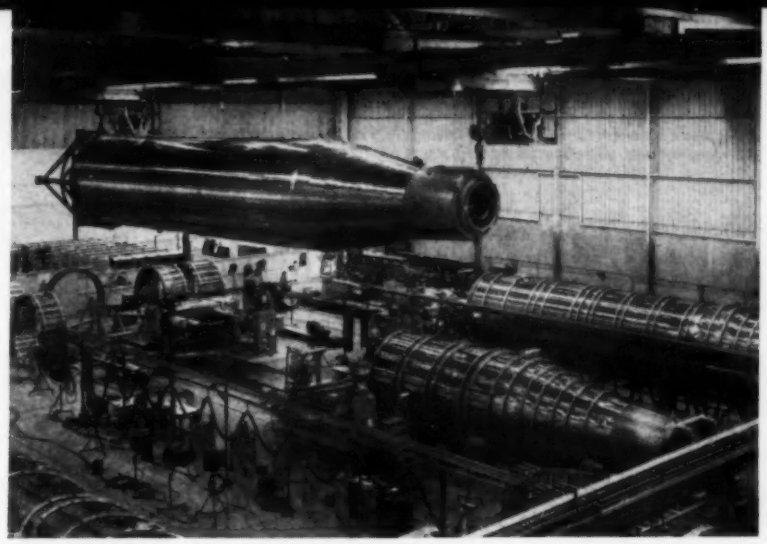
"The Conservative spells that word with an 'r' whilst the Socialist begins it with an 'n.' In practice it amounts to the same thing. If change is necessary then normal commercial processes would do what is required. The allocation of orders on technical merit would bring about the closing of any surplus capacity."

Nevertheless, is there not an argument on technical grounds for increasing the size and scope of research and development facilities of the present manufacturing units?

"You will remember the parable in the Bible of the rich man whose ground brought forth plentifully and who said, 'I will pull down my barns and build greater,' but God said unto him, 'Thou fool. This night thy soul shall be required of thee.' Are we not in danger of building bigger units only to overlook the fact that the soul of a business lies in the creativeness of the individual and that progress is not achieved by elephantine size or by soulless bureaucracy?"

As Sir Frederick spoke I thought of the great sprawling industrial empires, covering unconnected fields of production almost indiscriminately, and I was bound to confess to myself that there was much truth in what he said. Yet I pressed him further on this question of size of the production unit: *But if the projects of the future are to get larger and more complicated, does that of itself not mean that the resources of any particular unit must be increased?*

With the reply there was a quiet shrug of the shoulders. . . . "Young men shall see visions and your old men dream dreams. But our job is to get orders, to build aircraft and to provide employment. You help to bring down the fares; sell more of those bits of tickets; increase the demand for aircraft—and, given the chance, we will build them."



A high degree of accuracy in a series of 14 Atlas firings was announced by President Eisenhower on January 7 (news item below). Here a 60ft Atlas tank is transported (with supports removed and interior pressurized) from tank-manufacturing to final-assembly area at Convair (Astronautics), San Diego

Missiles and Spaceflight

ATLAS ACCURACY

In his State of the Union message to the American people on January 7, President Eisenhower said "In fourteen recent test launchings, at ranges of over five thousand miles, Atlas has been striking on an average within two miles of the target. This is less than the length of a jet runway—well within the circle of total destruction." This performance is quite outstanding and is significantly better than anything which had been expected. As was outlined in detail in our last "Missiles" issue (November 6 last), the original GE/Burroughs radio-comparison guidance has been transferred to Titan, and Atlas is now using the new all-inertial system developed for Titan by Bosch Arma.

FRENCH MISSILE PROGRAMME

Having developed an incredible number of somewhat rudimentary weapons during the past ten years, France is entering 1960 with a more rationalized programme which in many respects is comparable to our own, yet still embraces many more distinct types of weapon. The largest single item is undoubtedly the national desire to produce an IRBM.

It is at present by no means certain that financial assistance for this project will be provided by the USA. On December 17 it was announced in Washington that the US "will soon be ready to give full assistance" to an integrated NATO programme for a European IRBM, and Thomas Gates, the new Defense Secretary, was reported to have confirmed this in enthusiastic terms. It appears that France and Germany have put in a great deal of basic research effort at the former French arms factory in St. Louis, close to the border with Switzerland and Germany. Under the command of a French general a large staff of scientists is headed by Prof Schardin (former director of the Berlin Institute of Ballistics). Virtually all the work at St. Louis is currently being carried out by French and German nationals who must obtain rigid security clearance. According to the London *Daily Express*, British scientists are now to join these teams.

For at least two years the French have had their own SEREB (R & D ballistic vehicles) organization, charged with the task of developing an indigenous SSBS (*sol-sol ballistique stratégique*). Intended to succeed the Mirage 4A as a delivery system for French nuclear weapons, this missile is intended to be ready by approximately 1967 and would presumably be deployed in France and North Africa. Appropriations to SEREB have been increased to £7m this year and the overall work-load is being distributed between "air, marine and ground companies" and the maximum possible technical interchange is being established with friendly countries.

Future of the Nike Zeus anti-missile-missile programme ("Flight," January 1) is being determined by a series of experimental-vehicle launchings at White Sands, New Mexico. One shot in this series is pictured here. Attempted intercention of IRBM and ICBM warheads by Nike Zeus test vehicles in the Pacific will also take place

A great deal has also been said in recent weeks of the possibility of France, or France and Germany together, joining forces with Britain in the development and deployment of Blue Streak. Blue Streak is a considerably larger and more powerful missile than would appear to be needed for NATO defensive purposes, but there is no doubt that its progress is being watched very carefully by all NATO nations. Late this month it is expected that the French Chief of the General Staff, Gen Gaston Lavaud, will come to London for talks with Harold Watkinson, the British Minister of Defence. An unofficial source "close to the French Ministry of the Armed Forces" suggests that talks will centre upon the possibility of Blue Streak becoming a two- or three-nation programme. Previously talks had been held between Pierre Guillaumat (Minister of the Armed Forces) and Jean Blancard (Ministerial Delegate to the French Air Force) and members of the British Cabinet.

Regarding smaller weapons, France is a full partner with Western Germany, Belgium, Italy and the Netherlands in the manufacture of the Raytheon/US Army Hawk surface-to-air missile system and is continuing development of other types of weapon. The Nord AA-20 is now being developed into the AS-30 air-to-ground missile and an improved air-to-air form with collision-course ability is the Nord 5104. By about 1962 the even more advanced Matra 530 should become standard in the air-to-air role.

SOVIET PACIFIC ROCKET TEST

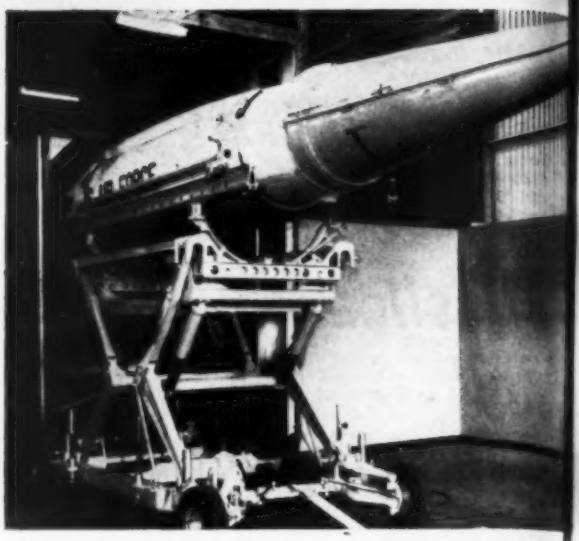
A warning that an advanced Soviet space rocket would be tested between January 15 and February 15, with an impact area in the central Pacific, was given in a Tass statement in Moscow on January 7. "To ensure the safety of navigation and air traffic," it was suggested that other countries should instruct captains of ships and aircraft to keep clear of this area, which lies about 1,000 miles east of the Marshall Islands.

The official statement said: "On the basis of the progress made by the Soviet Union in the exploration of cosmic space with the aid of ballistic rockets, and in conformity with their research programme, Soviet scientists and designers are now working to develop a more powerful rocket to launch heavy Earth satellites and undertake space flights to planets of the solar system.

"With a view to perfecting this rocket with a high accuracy of flight, its launchings without the last stage will be made within the coming months of 1960 into the central part of the Pacific Ocean, removed from places of intensive shipping, airlines and fisheries." After giving the position of the area where the rocket was expected to fall, the statement said that special ships of the Soviet Fleet would be despatched to the area to carry out "the necessary measurements."

SOVIET-US SPACE BILATERAL?

The possibility of a bilateral agreement on the peaceful uses of outer space between the USA and Russia was mentioned in a letter from the Soviet Embassy in Washington to congressman Victor Anfuso on January 5. Mr Anfuso had earlier written to



As noted in a news-item on this page, Boeing IM-99B Bomarcs are being delivered by road. The special handling trolley and radome protective casing are worthy of comment

Missiles and Spaceflight . . .

Mr Krushchev and President Eisenhower proposing joint space projects.

The letter stated "The Soviet government regards favourably the idea of concluding a bilateral agreement on the peaceful uses of outer space. If the Soviet Union receives definite proposals to start negotiations on this question, we shall be prepared to express our attitude towards them. The Soviet Union is ready to co-operate not only on a multilateral basis, as in the United Nations Committee, but also on a bilateral basis when such co-operation is based on mutually advantageous conditions . . ."

Mr Anfuso, who is a member of the Science and Astronautics Committee of the US House of Representatives, was among the speakers at the IAF Space Law Colloquium in London last September, and also visited the Soviet Union during that month.

TALKING ABOUT SPACE

Mrs Alla Masevich, vice-president of the astronomical council of the USSR Academy of Sciences and professor of astrophysics at Moscow University, is to make a lecture tour in this country next month under the auspices of the Society for Cultural Relations with the USSR. *The Conquest of Space* will be the title of her first presentation, to be given at the Royal Festival Hall, London, at 2.30 p.m. on Saturday, February 6. Other lectures will be given at Birmingham and Bristol on February 8 and 9 respectively; before the British Interplanetary Society (meeting open to the public) on February 10 at Church House, Westminster, at 7 p.m., when the title will be *Soviet Space Research;* and at the Free Trade Hall, Manchester, at 7 p.m. on February 12.

COSPAR SYMPOSIUM

The first international space science symposium to be organized by the Committee on Space Research (COSPAR) of the International Council of Scientific Unions (ICSU) was held in Nice earlier this week. The meeting, which began on January 11, dealt with experimental methods and scientific results obtained by means of rockets, satellites and space probes; but did not concern itself with the construction, propulsion and guidance of space vehicles, nor with legal questions and economically or socially useful applications of satellites.

Some 90 scientific papers, from 17 countries, were included in the programme. Eleven papers were presented by the UK delegation, led by Prof H. S. W. Massey, chairman of the British National Committee on Space Research. The British papers covered Skylark results, observations of artificial Earth satellites and theoretical deductions from such work, investigations of the lunar surface and Jodrell Bank observations on Lunik 2 and Lunik 3, together with instrumental aspects of this work.

At a meeting of COSPAR which preceded the symposium, a new constitution was adopted and Prof H. C. van der Hulst of the Netherlands was elected president. Prof A. A. Blagonravov of the Soviet Union and Dr R. W. Porter of the USA were elected vice-presidents.

According to the American publication *Missiles and Rockets* the Soviet Union is believed to be flight-testing a hypersonic vehicle in the same class as the Dyna-Soar. The story is said to stem from "European military sources."

Two-stage Italian rockets are to be fired during July from Sardinia up to a height of 130 miles. These launchings, the first in Italy's space-research programme, will be followed by further shots in which US Scout rockets are to be added to obtain an altitude of 430 miles. According to Prof Luigi Broglio, NASA will collaborate and provide some of the funds.

Several hundred Boeing IM-99B Bomarcs will be delivered to operational bases by road. These missiles leave the Seattle Plant on an Air Logistics handling trolley. Two missiles are carried in each van, the wings and tail being stowed at the sides. Rocket booster and ramjets are shipped separately from Thiokol and Marquardt, and the missile is assembled for the first time at the operational base.

Almost 2,000 RAF and USAF Thor students attended the training school at Tucson, Arizona, operated by Douglas for the USAF, over a period of 19 months prior to its recent closure. Thor training will in future be conducted by the USAF at Sheppard and Chanute AFBs—with final crew training, as previously, at Vandenberg. An informal presentation at Tucson is pictured below.

A £40,000 consignment of nuclear photographic emulsion, for use in balloon experiments to study high-energy nuclear particles at heights above 100,000ft, was flown to the USA from London Airport on December 31. Made by Ilford Ltd, the emulsion will be employed by a team of scientists from Chicago University who are working together with the US Navy and Air Force under a contract from the US National Science Foundation. The balloons will be launched from the Caribbean.

The *Daily Herald* reported on Saturday last that "The British Interplanetary Society has invited MPs and aircraft firms to a meeting next week to work out a Space Plan which will be submitted to Lord Hailsham." A BIS spokesman later described the meeting, which is due to be held today, January 15, as "one of a series undertaken by various groups, set up by the Society, who have under close review UK participation in space research." In the Society's opinion, he said, a "more dynamic" British programme, with "basic industrial participation," was required.

Graduation of final Thor course at Tucson (news-item above) was occasion of presentation of Papago Indian basket to class senior student Sqn Ldr P. J. Crowley, RAF (centre). Also present (l to r) were Douglas training supervisor Bryan Smith; Maj N. F. Crowder, USAF; Don Hummel, mayor of Tucson; and RAF administrator Flt Lt R. S. Mills

At the COSPAR symposium reported on this page, president H. C. van der Hulst (right) of the Netherlands greets Dr R. W. Porter of the USA

Oldest Aeronautical Society

THE STORY OF THE RAeS: PART 1

By FRANK H. SMITH

AS recorded earlier in this issue, the Royal Aeronautical Society celebrated, in London last Tuesday, both its 94th birthday and "the golden jubilee of that golden year in British aviation, 1910." The guest of honour was the Minister of Aviation, who was deputising for the Prime Minister. To mark the occasion "Flight" has secured a special historical contribution from the Society's librarian, the first instalment of which appears here

A CASUAL glance from the back windows of 4 Hamilton Place, London W1, in the past few months would have shown the beholder that the Royal Aeronautical Society was indulging in one of its favourite pastimes—turning over new ground. Only this time, in preparation for the new lecture hall, it is doing so literally, whereas in the past 94 years it has usually done it figuratively.

The very inception of the Society savoured of ground-breaking:—

"At a meeting held at Argyll Lodge Campden Hill the 12th January 1866 His Grace The Duke of Argyll presiding; Also present Mr. James Glaisher, Dr. Hugh W. Diamond, Mr. F. H. Wenham, Mr. James Wm. Butler and Mr. F. W. Brearey, Mr. Glaisher read the following address:

'The first application of the Balloon as a means of ascending into the upper regions of the atmosphere has been almost within the recollection of men now living but with the exception of some of the early experimenters it has scarcely occupied the attention of scientific men, nor has the subject of aeronautics been properly recognized as a distinct branch of science. . . .'"

Thus reads the very first page of the very first minute book of the Aeronautical Society of Great Britain. Mr Glaisher was pointing out that ballooning, which had for a long time been a means of entertaining people at fêtes and galas, an outlet for exhibitionists (albeit brave exhibitionists), could have scientific applications, and that it was about time somebody did something about it. Thus it came to be resolved at that first meeting "that it is desirable to form a Society for the purpose of increasing by experiments our knowledge of Aeronautics and for other purposes incidental thereto and that a Society be now formed under the title of the 'Aeronautical Society of Great Britain' to be supported by annual subscriptions and donations."

The oldest aeronautical society in the world today was born.

The Duke of Argyll was promptly elected president with the Duke of Sutherland and Lord Richard Grosvenor as vice-presidents; James Glaisher was treasurer and the honorary secretary was Fred W. Brearey. These officers were backed by a distinguished council, not lacking in Fellows of the Royal Society.

It has always been a matter of regret to the writer that these far-sighted gentlemen could not have met a few weeks earlier so that December 17 could have been an occasion for double celebration in the aeronautical world. It came very near to being so, for the Society's first account book shows entries of guinea subscriptions from F. H. Wenham and W. Wooler for December 13, 1865.

Evidently no time was lost in drawing up a set of rules (and, thank goodness, the council observed the rules of publication and dated them) and the 1866 version gives as the objects "The Society is established for the advancement of Aërial Navigation, and for Observations in Aërology connected therewith." The subscription was one guinea per year, with the option of compounding for ten guineas.

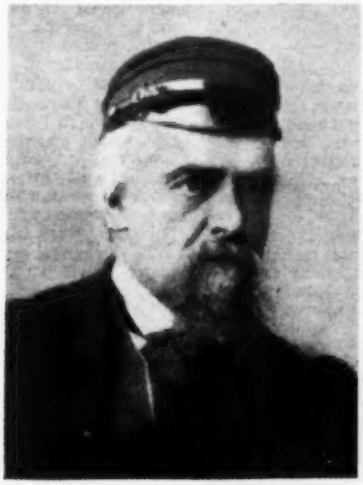
One must not dwell unduly on these rules, but para. 49 of section XVII (of "Experimental Aërial Ascents") says "Each voyager before taking his seat in the car, shall pay his just proportion of the cost of inflation, a sum not exceeding £2. . . ." One assumes that the gas managers insisted on this insurance.

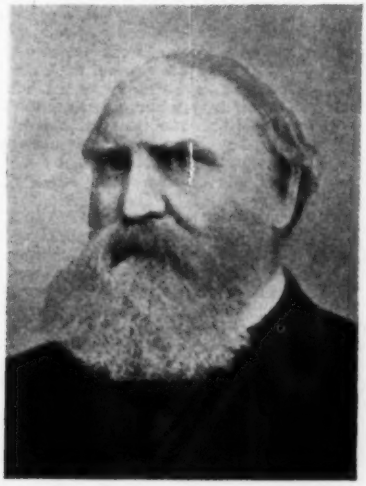
The second meeting took place one month later and a third on February 28, when the rules were presented and subsequently sent to the printers. At this last meeting, too, the hon secretary read a paper which started "It appears necessary, in view of checking the superabundance of schemes for aerial propulsion which are likely to claim the attention of the Council, that some mode of operation should be determined upon and published. . . ." He went on to describe how he had gone to the Birmingham meeting of the British Association (at the suggestion of Mr Glaisher) and there formed the nucleus of the Society. Brearey was secretary from 1866 to 1896—a thirty-year stint that has been approached by only one of his successors, Captain J. L. Pritchard, who served from 1925 to 1951. To these two men the Society owes much.

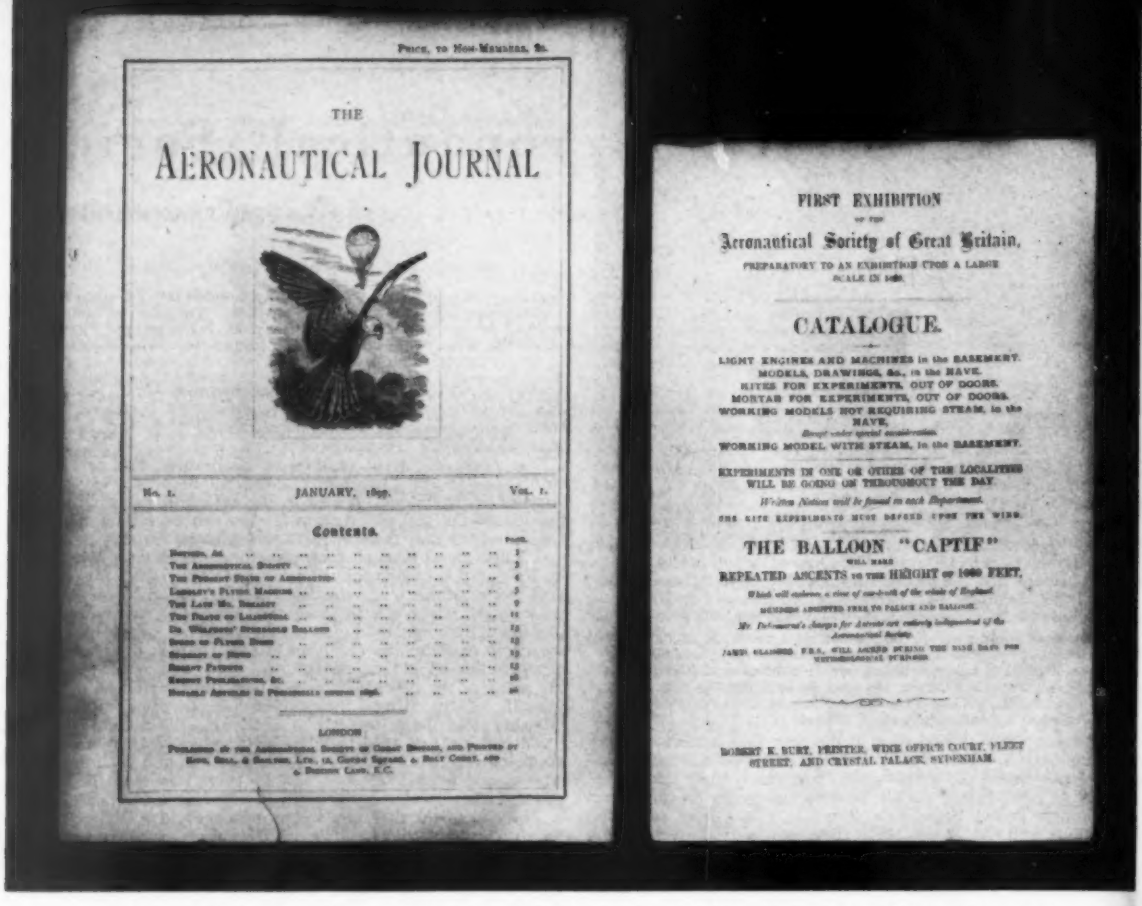
The end of the first year's operation showed a membership of 65 with a credit balance five shillings short of ten pounds. Of particular interest to the writer is a list, at the end of the first annual report, of eight "Books, Pamphlets, etc, Presented." Six have French titles. These, with some 40 patent specifications, formed the basis of the library. The specifications stretched back to those of Pauly and Egg in 1815 and the presentation of aeronautical specifications continues to this day. (It was a matter of great satisfaction that, for the first time in his ten years at the Society, the writer was able to lend something to the Patent Office Library at the beginning of December last. This is known as reciprocity.)

The second annual report (1867) closed with a membership list of 91, more specifications (including one by a Mr Boyman Boyman for "Machinery for propelling Vessels and Aerial Conveyances by re-action") and 16 more books and pamphlets—of which one only was French. During 1867 Brearey had the idea, which he put before the council on August 21, for an "Exhibition of Machinery and Articles connected with Aeronautics. . . ." Backing was promised and the council decided to go ahead. As a result, the final words of the first meeting of 1868 (held on March 25) closed with these remarks by the president ". . . the next meeting would be held at the Crystal Palace, where a number of models would

Three founder-officers of the Society in 1866: The Duke of Argyll (president); F. H. Wenham; and F. W. Brearey, hon secretary for 30 years







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LONDON

PUBLISHED BY THE AERONAUTICAL SOCIETY OF GREAT BRITAIN, AND PRINTED BY ...

FIRST EXHIBITION

OF THE

Aeronautical Society of Great Britain,

PREPARATORY TO AN EXHIBITION UPON A LARGE SCALE IN 1869.

CATALOGUE.

LIGHT ENGINES AND MACHINES in the BASEMENT.
MODELS, DRAWINGS, &c., in the NAVE.
KITES FOR EXPERIMENTS, OUT OF DOORS.
MORTAR FOR EXPERIMENTS, OUT OF DOORS.
WORKING MODELS NOT REQUIRING STEAM, in the NAVE.
Except under special consideration.
WORKING MODEL WITH STEAM, in the BASEMENT.

EXPERIMENTS IN ONE OR OTHER OF THE LOCALITIES WILL BE GOING ON THROUGHOUT THE DAY.

Written Notices will be found in each Department.

ONE GOOD EXPERIMENTS MUST DEPEND UPON THE WIND.

THE BALLOON "CAPTIF"

WILL MAKE

REPEATED ASCENTS TO THE HEIGHT OF 1000 FEET,

Which will enclose a view of one-tenth of the whole of England.

MEMBERS ADMITTED FREE TO PALACE AND BALLOON.

Mr. Coxwell's Assents for Ascents are entirely independent of the Aeronautical Society.

JAMES GLAISHER, F.R.S., WILL ASCEND DURING THE NINE DAYS FOR METEOROLOGICAL PURPOSES.

ROBERT K. BURT, PRINTER, WINE OFFICE COURT, FLEET STREET, AND CRYSTAL PALACE, SYDENHAM.

The covers of No 1 issue (January, 1897) of the Society's Journal and of the catalogue of the exhibition held in 1869

OLDEST AERONAUTICAL SOCIETY . . .

be shown, with some practical experiments, and amongst them, perhaps, this gentleman flying." This gentleman was a Mr Artingstall of Manchester. The final syllable of his name may be significant.

The catalogue of the exhibition ("preparatory to an exhibition upon a large scale in 1869") contained 77 entries in seven classes: Light engines and machinery; complete working aerial apparatus; models; ("Model of an Aerial Machine to go in any direction") working models; plans and illustrative drawings; separate articles connected with aeronautics; kites or other similar apparatus, "proposed to be used in cases of shipwreck, traction or in the attainment of other useful ends." This last was a class aimed at a prize of £50 offered by the Shipwrecked Mariners' Society for the best form of kite "for establishing a communication from a wreck on shore, or between two vessels at sea."

The Duke of Sutherland offered a prize of £100 to the inventor of a machine which, "not being of the nature of a kite or balloon, shall ascend with a man to the height of 120 feet." This money seems to have been pretty safe. But *the* exciting prize was the £100 offered to "the Exhibitor of the lightest Engine in proportion to its power from whatever source the power may be derived." Stringfellow's gaining of this prize is common knowledge, but anybody wishing to read more should consult the first Henson and Stringfellow Memorial lecture by J. L. Pritchard and A. M. Ballantyne in the *Journal of the Royal Aeronautical Society* for June 1956.

Of contemporary interest were Exhibits 8 and 9. The first was "Flying Machine—which being attached to the body, enables a person to take short flights. The exhibitor of this machine has, with less perfect apparatus accomplished flight to the extent of 160 feet, rising from the ground by a preparatory running action." The said exhibitor was Charles Spencer, a name more often associated with balloons. No 9 was "Complete Working Aerial Apparatus by Muscular Power" with no claims or details. In the report published after the exhibition, however, the exhibitor did explain that legs and arms worked together on two pairs of wings.

The first meeting of 1869 produced a communication from Captain Murray, RN, who suggested that the members of the Society were groping in the dark and suggested a prize be awarded for a complete and general solution, on rigid mathematical principles, of the following problem "Required, the relation between the velocity of a current of air and its pressure on a plain surface of given size, shape and inclination." The Society's attitude to this problem is outlined in Pritchard's paper in the *Journal* for March 1957, "The Dawn of Aerodynamics." At a meeting in July (1869) the hon secretary announced that he had lately received a communication from Chicago giving full particulars of an intended balloon voyage across the Atlantic. It took quite a time for such a trip to be tried in reality. . . . It is not such a Small World as one sometimes thinks.

One thing that strikes the reader of these early papers to the Society is the fact that speakers did not mince their words. They did not actually call each other mountebanks and fools and false claimants, but there can be little doubt that the implication was there. A Mr Walter Clare, for instance, in 1870, having asked why Spencer did not fly at the Crystal Palace, went on to say of a Mr Sheward that "had this gentleman calculated (or got someone else to do it for him) the power required to diminish the air above his machine . . . would . . . have found it enormous; indeed, I doubt if his engine would even find standing room on his aeroplane."

It must be admitted that this speaker had the welfare of the Society at heart. He said "Now let us consider the nature of the mud in which I have said we are stuck. The cause of the standstill, briefly stated, seems to be this: men do not consider the subject of aerostation or aviation to be a real science, but bring forward wild, impracticable, unmechanical and unmathematical schemes, wasting the time of the Society, and causing us to be looked upon as a laughing stock by an incredulous and sceptical public." I think Mr Clare bears looking into.

To the annual report for 1870 are appended some "concluding remarks" which touch on the use of balloons in besieged Paris and include:—

"The Aeronautical Society has been endeavouring for some time to inaugurate a systematic series of experiments on the connection between the pressure and velocity of air, and it is believed that these will afford the only data on which a true science of aeronautics can be founded.

"For this purpose an instrument has been designed by Mr F. H. Wenham and approved by the Experimental Committee, which it is intended to submit to the action of a fan not less than 30 inches in diameter, capable of delivering about 3,000 cubic feet of air per minute. A clear space of 15 feet or more in front of the fan will allow room for a square wooden trunk to guide the blast, ascertain its velocity, and insert the anemometer. . . ."

It would seem, from the opening paragraphs of the next session, that Wenham had asked a Mr Browning, FRAS (Astronomical, not Aeronautical), to construct the tunnel and the order had hardly been placed before a Mr R. A. Proctor (FRAS) had come forward with his hopes that "the inquiries will extend to the case of a plane body, caused to traverse the atmosphere (moving horizontally in its own plane)."

The same Mr Proctor said "I believe that the principle of the gyroscope will enter importantly into the construction of the aerial machine of the future." Unfortunately he said *construction*, and not *navigation*. The next paper in this session (1871) was by a civil engineer named Alexander on "Aerial Flight, as dependent on Man's Muscular Exertion." One of the contributors to the discussion was a Mr Sparrow; no comment.

The year's concluding remarks pointed out that two-thirds of the designs submitted were for the propulsion and guidance of balloons. The Society apparently did not think a lot of this, and persisted with its wind-tunnel experiments, for a tunnel had been completed and tested at Penns' Engineering Works at Greenwich. A table of results was given. "Though another season has elapsed, the Society has no announcement to make of a successful machine for aerial locomotion, or for travelling in any desired direction." Which might have been better expressed.

At the first meeting of 1872 "a new machine . . . for measuring the relation between the velocity and pressure of the wind" was exhibited. A footnote to the first page implies that if some of the papers appear to be so much bunk, they are printed in the hope that there may be some grain of sense in them. The new machine was the Wenham and Browning wind tunnel, and Wenham described its working. Judging from the brisk exchange of question and answer in the discussion, the wind tunnel idea caught on.

In the *Daily Telegraph* of December 7 last an article concluded "Little is heard in this country about the study of insects in this context of man-powered flight. . . ." In the annual report of the Aeronautical Society for 1872 is given a translation of a French paper entitled "The Movements of the Wing of Insects." This was an extension of some abstracts that had previously been published in the report and were now printed *in extenso* in response to the demand of the membership. They cover pages 25 to 74 and are illustrated.

The historic documents illustrated in these pages are in the RAeS library under the care of Frank Smith, author of this article

(Right) Paid-up members in 1865: a page from the account book. On the following page the subscription total rises to £27 1s

In 1873 Mr Artingstall persisted with his ideas for man-powered flight. D. S. Brown read a paper on the Aëroplane with such headings as "Construction: Position: Stability: Propellers: Motors:." He referred frequently to that father of flight, Sir George Cayley, to whose writings he had evidently given much time. In this year, too, appeared a paper that was so long that it could not be read at a meeting. By James Armour, C.E., it was called "Wings for Man." A preamble remarked "the manner in which the question is treated will show that the title 'Wings for Man' signifies not wings absolute, but wings in the form of a proposition simply." You can't have much fairer than that. Fifty-three pages of it, in thirteen chapters.

It is interesting to note that costs come into a paper read in 1874. Mr Moy asked the price of aluminium for constructing a boiler. Mr Brown said about 8s per oz. Mr Wenham said it was about 5s in bulk and the chairman came in with the opinion that it could be got at about 4s. That's how things start.

Again, in 1874, Mr Armour had a paper which was taken as read. His "Resistance to falling planes on a path of translation" ran to 25 pages, but the type is larger than the previous marathon effort. In the concluding remarks to this year appear what may be the first steps in direction finding. Captain Burnaby of the Society's council dropped from his balloon two parachutes, with an interval of time between their liberation. By observing the direction of a silken cord which connected the two, he was enabled to verify his course. No further directions are given.

The opening meeting of 1875 was notable for Thomas Moy's paper on his Aerial Steamer. With its appearance of owl's eyes and no body this made one of the best-known of the old illustrations. It was followed by a rather depressing paper by the chairman on "Death of Crocé-Spinelli and Sivel." The discussion was most lively.

Now follows another of those papers that were printed but not read. It is called "Angus and Mack on the Air Path" and is a species of cross-talk act between, for some unknown reason, two Scots. In dialect, too. If two comedians would only learn the 27 page "script" it would be a riot on today's radio.

In 1875, Brearey, the hon secretary, was awarded the Gold Medal of the Société Française de Navigation Aerienne; and this is really the only item of Society interest in the concluding remarks for that year.

The 1876 report is largely made up of translations of papers by Pénaud and the reproduction of Cayley's "On Aerial Navigation" in *Nicholson's Journal* of 1809 and 1810. Among the concluding remarks for the year is a report of the death of Mr Artingstall of Manchester, who (as we have already implied) was a vigorous contributor to the earlier annual reports.

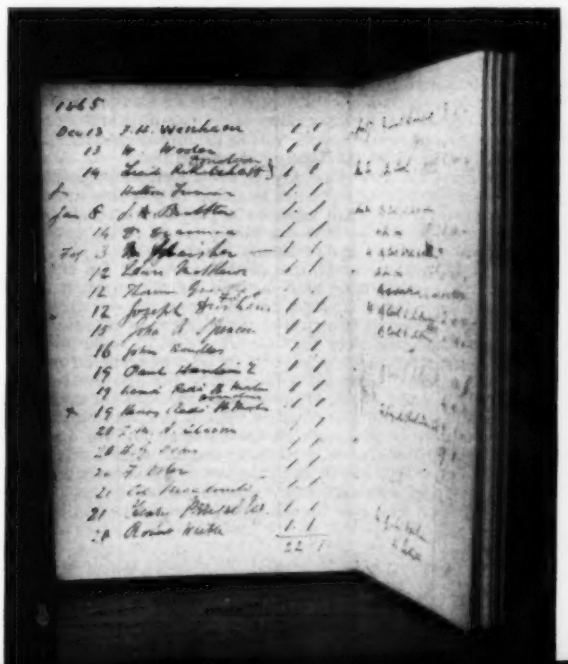
In 1877 there were one or two acrimonious discussions, including one on the omission of a balloon from the "Challenger" polar expedition. At the end of the report was reprinted an 1810 "Treatise upon the Art of Flying" by one Thomas Walker, a portrait painter of Hull: another demonstration of the fact that in those days it was not considered necessary to have any special qualifications for aeronautical authorship. A note of the books received during the year mentions "Angus and Mack on the Air Path—Part III," and the author is none other than James Armour.

The report for 1878 opens with the annual meeting on June 13, with the redoubtable James Glaisher still in the chair. Mr Moy opened with a defence of his flying model and was followed by Mr Cradock on "The Power possessed by Man in Relation to Aeronautics." There are other communicated papers, but no report of a meeting. There was, however, an Aeronautical Club which met each month, on the third Tuesday from October to May. The Annual Subscription was 10s 6d.

The concluding remarks for the year 1879 start with the simple sentence "Balloons have again come to the front." It goes on "There seems to be a recurring cycle when men, hopeless of macadamizing the aerial highway, resort again to the gas bag." Gas bag, here, is literally descriptive and not a vulgarism. The subsequent remarks are somewhat disparaging of those who were thinking in terms of what we now know as the airship, but there is a bit of happy prophecy in dismissing the cigar or cylinder: "There may, and probably will, arise conditions in warfare in which considerations of expense in the attainment of an object will sink into insignificance in the prospect of success."

The 1880 annual report shows a returning interest in the flight of birds. In June *The English Mechanic* published a series of letters on this subject and the correspondence is reproduced in the ASGB report. This may have been because of a dearth of other material, for in the short history he produced in 1946 Capt Pritchard says that the years 1881 to 1896 found the Society in the doldrums. It is interesting, nevertheless, to see, in the annual report for 1882, correspondence signed by a gentleman from University College, Bristol, named H. S. Hele-Shaw. This was reproduced from the *Engineer*.

(*To be continued*)


1865
Dec 13 J.H. Wenham 1 1
13 W. Woolen 1 1
14 Lieut. Baldwin 1 1
Jan 8 J. A. Brabbon 1 1
14 [illegible] 1 1
Feb 3 [illegible] 1 1
12 Edwin Matthews 1 1
12 Thomas Grist Esq. 1 1
12 Joseph Gristwood 1 1
15 John A. Spencer 1 1
16 John Rowlett 1 1
19 Charles Hawkins Esq 1 1
19 Lieut. Rose & Mrs [illegible] 1 1
19 Henry Cecil Pelham 1 1
21 J. M. S. Broom 1 1
28 H. F. Coom 1 1
Mar 2 F. Usher 1 1
21 Col. Thomas Lewis 1 1
21 Lieut. Pittard 1 1
Apr 1 Arthur Watts 1 1
22 1

Nine Days to Christmas

DIARY OF A SOUTH AMERICAN PROVING FLIGHT

THIS is the second article by a "Flight" staff-member who took part in a BOAC Comet proving flight across South America to Santiago and back. The first, "South American Rentrée," published last week, dealt with the commercial aspects of this highly competitive route; the present account is concerned with the day-to-day operational tasks of re-opening a service after a lapse of nearly six years.

A PROVING flight lacks the even pattern of a scheduled service; in retrospect it can be seen as an unending vista of airport buses; of night stops at hotels; of transit lounges and Customs clearances; and of revisions in schedule—interspersed with the relaxing comfort and hospitality of BOAC Comet travel. This particular flight had the added excitement of anticipation; it was due to return to London Airport at midday on Christmas Eve—a target that passengers and crew without exception were anxious should be kept. This account is in the form of a diary of the nine days prior to Christmas—ending, as it should have done, at midday on Christmas Eve.

* * *

It was a rather anticlimactic start to nine days' travelling down what is now the Comet route to Santiago: an extra 12 hours for line maintenance and another half hour's delay in loading baggage set back Comet G-APDR's departure until 8.30 p.m. on a day on which we had expected to be away from London before breakfast. Already, with 14,000 miles' flying ahead of us, doubts are expressed that the schedule would be flexible enough to tolerate any new delay that might occur. Philosophically, I write in my diary, "**First Day**: *London - Madrid*, 752 n.m., estimated flight time, 2½hr." It has been raining in London, and South America somehow seems a very long way away.

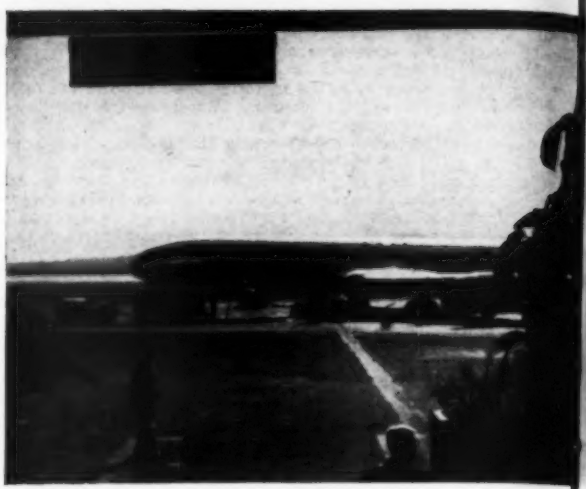
We are to touch down at each of the calling points on the BOAC route, at many of them practising approach procedures for the benefit of the eight captains on board. At others we are to give BOAC Comet demonstrations for the benefit of civic dignitaries, station staffs, local newspapers, restaurant owners and others likely to be concerned with, or interested in, the resumed operations of BOAC on the South Atlantic route. There is much to do on a proving flight; and this one—the third and probably the last before the inaugural on January 25—is to lay heavy responsibilities on the aircraft commander, Capt R. E. C. Millichap.

By ALASTAIR PUGH

But there is a good deal more to a proving flight than providing route experience for the crews (some of the captains already knew—and remembered—the airfields from York and Argonaut days; others had flown these routes with BSAA in many times longer than the Comet will take). *En route*, let-down and terminal aids must be checked, the best approaches verified or determined, timetable schedules proved, airfield approaches and runways studied and a careful appraisal made of fuelling and of the manner in which ground handling is carried out—both of the aircraft and of its fare-paying passengers. A proving flight also provides very necessary expérience for controllers in jet handling and jet clearances, and practice for ground crews in turning around the Comet in the busy 45 minutes that is the corporation's aim.

The three Comet proving flights, moreover, are regarded by BOAC as a valuable opportunity to publicize a return to a route that for business in South America depends very much on the publicity that the corporation can obtain for it; so the passenger list includes a number of British and South American journalists as well as BOAC observers, one of whom at least (an electrical engineer) says confidently that he will be disappointed if his specialized knowledge is required—he, for one, certainly does not expect the Comet's electrical system to give any trouble. Most of the rest of the passenger seats are filled with 22 supernumerary captains, engineers and cabin staff, for the moment off-duty.

At Madrid, first outbound calling point, the overcast is down to 700ft. We make a full ILS approach through the drizzle to kiss the runway in the first of many smooth landings, but taxying on to the apron we lose sight of the batsman and for a minute or two search blindly on a tarmac shared with Languedocs, Norécrins and a Fox Moth. We disembark; then comes an interminable wait under a suspiciously permanent-looking notice bearing the legend "The bus for Madrid is now being loaded with your baggage and will be here in a few minutes" while it becomes. . . .

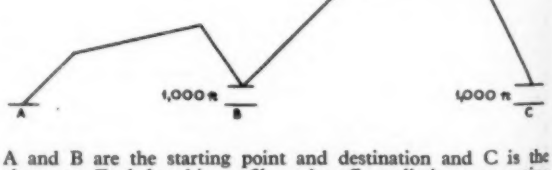


Aerolineas Argentinas can no longer claim to operate "un seul jet Comet 4 sur l'Atlantique du Sud"; but, compromising with the competition, they handle us very efficiently at Dakar

The Second Day. *Madrid - Lisbon.* An easy stage for the passengers, more arduous for the operating crew: a morning demonstration flight at Madrid and then an hour's flight on MF beacons to Lisbon, with a practice ILS at the end of it for Captains Minns and Nelson, respective occupiers of the left- and right-hand pilots' seats. This is one of the two ultra-short stages on the route (the other is Montevideo - Buenos Aires) and our take-off weight—in spite of near-capacity payload—is only 58,610kg. We use under 4,000ft to leave the runway and reach a height of 35,000ft before starting a dive-brakes-open descent into Lisbon. The crew give a demonstration from the fresh green airfield, offering their passengers a fine view of the little white houses dotted on the undulating hills, the rivers meandering through pretty valleys and the sardine boats in the Tagus estuary.

Third Day. *Lisbon - Dakar:* 1,529 n.m. and a good Comet stage. Soon after take-off the cabin becomes crowded with passengers and crew stretching their legs, reaching for magazines and starting conversations: a sure sign that the flight is settling down. Off-duty crews are only too anxious to discuss the Comet: "The best aeroplane we have ever had" is the concensus of pilot opinion, "and because of its power reserve perhaps the most delightful and safest we shall fly for a long time to come." Asked for an example, one of the off-duty pilots, Capt Worrall, replies "I think the best illustration I can give you—and certainly it's one that gives me the most confidence—is in that part of the manual dealing with an overshoot with two engines out: it reminds us to *reduce power* to keep the speed within limits during the climbout." With Capt Minns he goes on to explain for me the method of flight planning that BOAC has now adopted for all its Comet routes—South American included—so that the system is standardized wherever the Comet may fly.

The flight plan profile can be drawn out as follows, where



A and B are the starting point and destination and C is the alternate. Fuel for this profile—take off, a climb to operating altitude, cruise climb to the start of a descent to 1,000ft over the destination, a wave-off and climb back to operating height for a continuation of the cruise climb procedure and a descent to 1,000ft over the alternate, are written into the operating manual and can be directly obtained by reference to the particular stage and corrected in pre-flight planning for wind component and temperature. Irrespective of the amount of fuel represented, to this quantity is added 500kg taxying fuel, 1,500kg absolute minimum fuel allowance overhead the alternate (for navigational con-

(Left) White paint and sunshine at Dakar while we wait for nightfall and the South Atlantic crossing to Brazil. (Right) Below is Santiago, overlooked by the snow-topped Andes. We climb to 30,000ft overhead before setting course for home

Nine Days to Christmas . . .

tingencies, deviations from forecast winds and so on) and a further 2,500kg "station contingency" fuel to cover holding, descent, a circuit and landing and 500kg residual fuel in the tanks. This 2,500kg varies from station to station; at Santiago for instance, where the Andes necessitate a descent from almost directly overhead, it is considerably increased; at London it can be reduced.

Minimum reserve is uplifted at the commander's discretion; normally more fuel will be taken on board if the payload, weather or fuel price warrant it. Translating this quantity into gallons is the responsibility of the flight engineer, who compiles a fuelling record which gives the fuel required in gallons after correction for density of that in the bowser. Residual fuel in the aircraft must also be density-checked, and on each refuelling stop it is one of the engineer's duties to check a hydrometer reading of the fuel bled off from the dripsticks, correct for density and calculate the total fuel required.

Very soon after take-off the Comet must be throttled back to prevent exceeding the maximum permissible i.a.s. before the flaps and undercarriage are raised. Our aircraft, equipped with Avon 524Bs and thrust reverse has available 8,050 r.p.m. for take-off and we climb at 260kt i.a.s. at 7,350 r.p.m. to 30,000ft. This is the height at which a constant-i.a.s. climb is abandoned for a climb at constant Mach number and from here up to the cruising height we maintain M0.7, the i.a.s. reducing by 4kt for each additional 1,000ft of height.

There are three cruising techniques for the Comet: corporation policy is to use the best-economy cruise at M0.73 (1.15 × minimum drag speed) but there is also a high-speed technique at 1.2 V_{md} and a Mach number of 0.75, while for maximum range the aircraft is flown at a Mach number of 0.69 (1.06 V_{md}). Ideally, cruising altitude should be kept within limits of about ±500ft but if air traffic control demands a departure from the ideal height for the particular weight, either the cruising Mach number must be reduced if the altitude is too high, or a level-cruise technique at M0.69 can be adopted if it is too low. The other alternative in the latter case is simply to accept the fuel penalty involved.

Because fuel consumptions can be approximately gauged it is easy enough to estimate the height at which the Comet must be levelled off, but towards the top of the climb the flight engineer will prepare a "top of climb" weight statement from which the correct cruising altitude can be more closely determined. When this altitude is reached the height lock on the autopilot is plugged in and the aircraft is allowed to accelerate on climbing power until the correct Mach number is reached. At this speed the autopilot is transferred from height lock to speed lock, power reduced to between 6,800 to 7,100 r.p.m. (depending upon the outside air temperature) and the aircraft allowed to drift up in its cruise climb through about 300ft to 400ft every 15 minutes. Briefly, r.p.m. depends upon temperature and altitude depends upon weight, so that as the weight is reduced during the cruise —it drops about 1,000kg every 15 minutes—the airspeed is adjusted and the height is checked.

The flight engineer is occupied during the climb with the fuel consumption and weight statements which are passed forward about every 12 minutes; each takes about five minutes to complete. After the climb, fuel-flows stabilize at under 1,000kg/hr, dropping to 600kg/hr as weight is burnt off, and during the cruise a weight statement is then completed at intervals of about half an hour. From these statements the navigator completes a running Howgozit chart showing how fuel actually used has compared with that estimated for the climb and cruise climb, and time early or late at the various reporting points.

In the intervals between complete fuel statements the engineer is monitoring the panel and logging the readings—a check on instantaneous observations and a good guide to a drift in the reading of any instrument.

About 150 n.m. from destination the inboards are brought back to ground idle and r.p.m. on the outers adjusted to establish an indicated airspeed of about 220kt. The average rate of descent is then about 1,200ft/min; speed brakes are not normally used, as a clean aircraft gives the best economy; but in practice they are employed as the occasion demands. They increase the rate of descent to 3,000ft/min.

We are given a good illustration of this while descending into Dakar; after a long, smooth descent from the 37,000ft reached on the cruise-climb we use airbrakes to steepen the descent into the haze over the narrow neck of land that is Dakar. A surprise here is two airfields, one small with dark runways, the other new and much larger, with concrete runways over 9,000ft long. We take a good look at it as we sweep over the old airfield, but no information about it was available before we left London and it is only on landing that we find that Air France Boeing 707s have already used it for demonstrations. By January 25, when services start, it should be available for BOAC's Comets.

A hot afternoon in Dakar is occupied with another two demonstration flights for the duty crew and with sightseeing for the passengers—the latter escorted by a friendly and knowledgeable Gambian guide. There is no great urgency to leave; aids are few over the South Atlantic and the schedule determines that the crossing be made at night, using the mariner's centuries-old aids of dead reckoning and astro-navigation.

As we head westward the darkness begins to overtake us; the great cloud-masses of the intertropical front converge on every side and grey cloud fingers stretch above us to the lonely heights.

Soon we are experiencing what crews refer to as "meal-time turbulence," the bumpy ride that frequently seems to accompany the serving of dinner. With the scanner undepressed, the radar is indicating a solid front of cloud, and we divert slightly to avoid it.

Four and a half hours after leaving Africa we are touching down in South America—at Recife, Brazil, hot and tropical even in the evening air. Clambering down the unlit steps into the darkness we trail unescorted across the apron towards the terminal, suddenly to be confronted with a Panair do Brasil DC-7C set upon taxying across the same stretch of concrete. It switches on its landing lights and stops, but not before the crocodile of Comet passengers has split up in alarm.

Fourth Day. *Recife - Montevideo.* To the dismay of the Brazilian journalists on their way home, the cloudbase is well below the 1,000ft minimum required for a let-down on the one NDB which is Sao Paulo's solitary aid, and we fill up with 30,000kg of Querosene (the local brew) to overfly to Montevideo. This is our heaviest load yet and it brings us to maximum weight for take-off. For this leg I am invited—provided I make myself sufficiently inconspicuous—to watch part of the flight from the cockpit. There is not much room to spare; but, astonishingly, eight of us manage to squeeze in to see the take-off: Captains Beauchamp and Moore in the front seats; a third pilot on one edge of the jump seat; a flight engineer under training at the engineer's panel; a qualified engineer behind him; a BOAC communication's engineer listening in to the R/T; and Capt Millichap, there to check the operation in his capacity as commander.

Refreshing cologne-soaked towels come forward from the galley; the Comet is hot after hours in the sun. Checks completed, engines are started and we taxi to the end of the runway. It is hot and we are heavy, and Capt Beauchamp gets full thrust from the Avons before he releases the brakes. We use 6,900ft of runway but, as always, the Comet makes light work of the take-off. Capt Moore calls V_1 at 109kt, V_2 at 122kt, then the nose vibrates as the gear comes up and we climb steeply away, receiving Speedbird Jet 010's climb clearance on 190 deg as we go. "True or magnetic?" we query Recife repeatedly, but the question seems not to be understood.

From Recife down to San Salvador, one of our reporting points, we have a choice of three different operating heights on the red, green or amber airway but we ignore them all and set course for Uruguay direct. Navigation over this sector is by dead reckoning, but ADF is used to pick off the NDBs at San Salvador and Porte Allegre and HF for communication with Recife and Salvador, who are relaying to Montevideo our request for terminal weather. We receive all HF transmissions with a background of music, and enjoy snatches of catchy South American dance rhythms 36,000ft above the South Atlantic.

The music and the radio provide the pilots with a new source

(Left) Skyscrapers and underpasses; a typical Sao Paulo street scene. BOAC could no longer afford to ignore the market that these communities represent

(Right) BOAC experiment with new ideas in interior decoration for the flight home on Christmas Eve. With his back to the camera is Capt Millichap, the aircraft commander

Nine Days to Christmas . . .

of *bon mots* for R/T exchanges around the cockpit; and soon the tea comes forward and the four operating crew settle down to their trained working rhythm. This is the longest sector we shall fly, 2,010 n.m., and for much of it the South American coastline is in view. Then the promised front closes in beneath, and all we see of Rio's famous harbour is the outline faintly delineated by the sunlit, oscillating trace of the map-painting radar.

After nearly five hours at cruising height the inboard power levers come back and we start the descent; the spill valves shed compressor air with their characteristic roar. Condensation in the cockpit is considerable, and for some minutes the roof drips steadily; the towels that on take-off provided welcome relief from the heat now come in handy again.

There are two NDBs at Montevideo's Carasco airport and we line up on the one that leads us into the holding pattern. In theory there should be 7,000ft of runway, but we call for a check on the effective length and on the approach the keen eye of Capt Millichap notices that the flanking trees have grown 20ft since the last survey and now form a possible obstruction.

The BOAC station staff at Carasco handle us efficiently, presenting typed briefing sheets prepared in the three hours' notice that they have had since we radioed ahead that we were to overfly Sao Paulo. Montevideo's beach and waterfront by night is a dramatic sight and the city centre is splendid—modern, attractive and full of Model A Fords.

Fifth Day. *Montevideo - Buenos Aires.* From Carasco we climb away with characteristic Comet steepness to 24,000ft and then make an immediate descent along the River Plate towards Buenos Aires into Ezeiza's complex holding-pattern. This is one of the few South American airports equipped with ILS and VOR; but the weather is good, and after examining the holding procedures we land and taxi on to the apron amidst an Austral C-46, Aerovias Guest yellow and blue DC-6s, a pair of modified Argentine Air Force Lancastrians and a gleaming, just-delivered Transcontinental Britannia, resplendent in its white paint. In spite of all these aircraft, the airport is strangely quiet. "Looking at the book," one captain said later, "with its special sectors and holding arrangements, you'd expect to find that airport frantically busy, but I've only seen one movement since we landed." Perhaps it was lunch-time or siesta but in the large and impressive new terminal building the meal service was woefully slow. A 45-minute turn-round is clearly going to present some problems here.

Buenos Aires - Santiago. Now for the last outbound stage, across the Andes into Santiago. The city lies on a plain between mountains which form the foothills of the great mountain range; outer hills on the approach jut up suddenly and near-vertically from the cultivated fields. We navigate by MF beacons, the Andes VOR and Santiago's DME, and let down west of the airport for a brief glimpse of the Pacific. Low down, the crews change over, and for half an hour we are treated to some exhilarating low-level local flying among the foothills, while the crew examine the terrain and select a possible visual approach by lining up with two gasometers. The standard two-NDB let-down race-track pattern, we find, is too tight for the Comet to follow at altitude. In future, the commander decides, we shall come overhead at 30,000ft, start a timed let-down to the west to ascertain drift, back-track below 20,000ft and start the jet procedure for holding the race-track between the two NDBs; a Eureka beacon is to be installed to improve the overhead reception of the beacon signals.

Los Cerrillos Aerodrome temperature is 86°F and for the first time in South America we are certain enough of the cleanliness of the runway surface to use reverse thrust.

Sixth Day. *Santiago - Buenos Aires; Buenos Aires - Sao Paulo.* For our departure from Santiago de Chile the station staff line up smartly and the station officer salutes as we leave. Gaining height in three great circling sweeps on pre-set turns on the Smith's flight system, at 30,000ft we head out over the Andes and for home.

We try for a rapid turn-round at Buenos Aires, but it is 1½hr before we are airborne again—just about the time that Capt Millichap forecast. There has been some difficulty with the runway NDBs; they are coded for identification of the runway direction in use, but when we try to use them they are found to be aligned with quite another runway. *En route* to Sao Paulo we start a let-down to Rio, but below us is tragedy: a VASP Viscount has been struck by a Brazilian air force trainer and at 15,000ft we are waved off and alter course for Sao Paulo.

Seventh Day. *Sao Paulo - Recife.* Take-off weight is 64,270kg and we clear the runway in 6,700ft in a temperature of ISA+33°C. Again we navigate by dead reckoning, checking with coastal and *en route* beacons and broadcast stations.

Eighth Day. *Recife - Dakar.* Tomorrow is Christmas Eve, but today passengers and crew relax together on Recife's white palm-fringed beach. At Sao Paulo we had been given a detailed record compiled by the Brazilian Air Force of the weather at Cumbica Airport. Fortuitously, the diurnal trend is distinct and indicates a high incidence of VMC weather during daylight hours; this fits in well with a schedule that demands a night crossing of the South Atlantic.

For the ocean leg the Comet is festive: the cabin crews have decorated it with balloons and little parachutes from which dangle miniature Father Christmases. I lose my bet that the balloons will burst under differential pressure—the engineers suggest that it is all a matter of temperature accountability.

The cabin staff's hard work is rewarded by the pilots, who change jackets with the stewards and serve a pre-Christmas dinner (including plum pudding *flambé*) with considerable aplomb. Capt Minns apologizes from the cockpit for the usual meal-time turbulence; but on this occasion apparently, it is the result of a new navigational hazard—something to do with sleds and reindeer. A minute later Father Christmas appears from the direction of the rear door and distributes presents to the passengers from the silver trolley.

Ninth Day. *Dakar - Lisbon - London.* At Dakar the Comet seems too warm and comfortable for many to want to leave. We rapidly load 26,000kg of fuel and by D/R, Loran, Consol and astro fly on into the dawn and a practice ILS let-down at Lisbon. We awake to the realization that this is Christmas Eve; that we are on schedule; and that we have every chance of being home on time. Anxiously we ask for news of London's weather. Our alternates are Prestwick and Hurn and everyone discusses the possibilities of getting home from there. But there is no need to worry; headwinds will delay the Comet a matter of minutes but the weather is clear. Lisbon's controller gives clearance and wishes us "A Merry Christmas" and we hear the familiar greeting from other unseen voices as successive clearances mark our journey home.

As we drop below cloud Southern England stretches welcomingly ahead; we pass Southampton water, descend over Dunsfold and pick up the Epsom beacon, and London's reassuring radar guides us down to the runway approach lights. The flaps go down, then fully down as we cross the threshold and Capt Worral greases-on the Comet in one of those once-in-a-thousand landings that brings from him a whoop of delight. We are home.

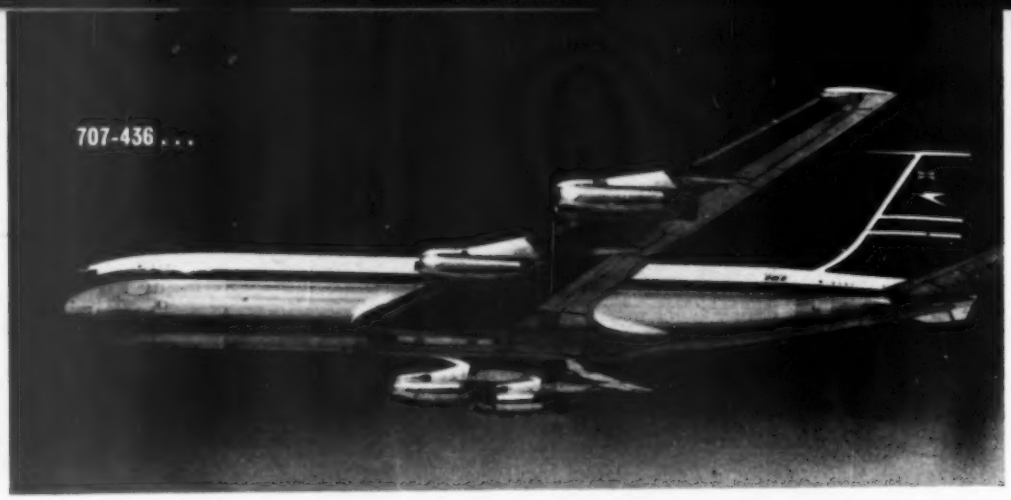
SOUTH AMERICAN ROUTE AIRPORT AIDS

Airport	VDF	NDB	Radio Range	ILS	VOR	Eureka
Madrid	☆	☆		☆	☆	
Lisbon	☆	☆	☆	☆	☆	
Dakar	☆	☆	☆	☆	☆	planned
Recife		☆				inoperative
Sao Paulo		☆				
Montevideo	☆	☆			☆	
Buenos Aires ...		☆		☆		
Santiago	☆	☆			U/S	planned
Rio de Janeiro ...						
(Galeao)		☆				
(Santa Cruz) ...		☆	On request			

707-436

BOAC GET THEIR FIRST BIG JET

WHEN the big Vickers-Armstrongs V.1000 was cancelled in November 1955, BOAC were faced with the unpalatable alternatives of either buying more American equipment or of ceasing to be competitive. This was no new situation for the Corporation, but the blow was softened by the fact that the big jet upon which their choice finally fell includes a substantial



contribution from British manufacturers. In particular, like the Argonaut before it, its transatlantic airframe is powered by Rolls-Royce engines.

It was on November 8, 1956, that the constructor and operator signed the contract for fifteen Boeing 707-436s. Their value was then given as some £44m, including spares, of which about £9m was accounted for by the powerplants. Even at this time BOAC were anxious not to depart from their avowed policy of buying British whenever possible, and the order for 707s was coupled with confirmation of the Corporation's interest in the D.H.118. In the event, de Havilland ultimately became associated with BEA and a smaller aeroplane, while BOAC have bought the VC10.

Nevertheless, the 707-436 is no mere stop-gap, and is a very fine transport indeed. Its certification trials are virtually complete, notwithstanding much extra effort necessitated by the ARB's insistence upon the demonstration of take-offs in all configurations. No measured figures have yet been issued. When they are it will be instructive to compare the payload/range performance of the 420-series with the comparable 707-320 family powered by the JT4A-3. The former has 8,800lb more average installed thrust (ISA sea-level static) and also has an empty weight 2,000lb less. Moreover, it is certain that the Conway-powered machine flies further on each pound of fuel, assuming identical operating conditions in each case.

The proof of this pudding will not have to wait very long, for the first "Jetliner 707" is due to be delivered from Seattle to London Airport at about the time this issue appears, and will go into scheduled service in April. According to information provided by the manufacturer, it has a capacity payload of 55,000lb (theoretical tourist seating can be provided for 189 passengers), which can be carried with SR427 reserves for 4,450 miles. Maximum continuous cruise is given as 520kt (598 m.p.h.) at 260,000lb at 23,000ft, but in practice the -436 will be flown higher and somewhat slower. Seat-mile costs have been stated to be appreciably less than those of the types which these great aircraft will replace, and by the time the last of the fleet is delivered, late this year, their capacity over the Atlantic will be three times as great as that of all BOAC airliners at present flying on these routes.

BRITISH CONTRIBUTORS

The following list, furnished by BOAC, indicates how many British firms are contributing to the Corporation's new Jetliner 707 fleet: Airmed, Airlite headset; AERE, isotope containers; Beaufort Air/Sea Equipment, life vests and infant flotation cots; Camerer Cuss, clocks; Compra Plastics, life-vest notice; Cossor, ATC transponder; Creed, teleprinter; Dunlop, reverser rams; Ekco, weather radar; Ferranti, artificial horizon and invertor-regulator; Fire Armour, crash axe; G.E.C., beverage containers, ovens, hot cups and safety flashlights; Graviner, fire extinguishers; Hickman, Airlarda mealbox and amenity cabinets; Kelvin & Hughes, periscopic sextant; Joseph Lucas (GTE), fuel control unit and engine fuel system; Marconi's Wireless Telegraph, ADF system; Marston Excelsior, fuel/oil heat exchanger; Microcell, passenger seating; Miller Grinding & Tinning, cigarette suitcase; Mine Safety Appliance, portable oxygen bottle and mask; Morris Motors, fuel/oil heat exchanger; Murphy, entertainment tape-recorder; Palmer Aero Products, escape chutes; Purolator, air filter; R.F.D., life rafts and emergency packs; Rolls-Royce, complete powerplant; Rotax, engine igniters; Siebe, Gorman, rebreathing masks; Tea Service Equipment, trolleys; Teddington Aircraft Controls, thermostatic valve; Ultra Electric, interphone and engine control (r.p.m. and temperature); Walter Kidde, oxygen equipment.

CONWAY

THE EVOLUTION OF THE FIRST ROLLS-ROYCE BY-PASS TURBOJET

WITH the Rolls-Royce Dart turboprop Britain won, for the first time in history, a substantial slice of the market in airline powerplants. This was achieved not by any intrinsic efficiency of the Dart so much as by the fact that it worked reliably and was available at a time when few of its competitors could do either (and none both). In contrast, the Rolls-Royce Conway by-pass turbojet has from the outset had to contend with keen competition from engines which in most respects are quite comparable.

With the advent of the American "Big Jets" a situation has arisen in which the world's airlines can choose either American or British powerplants for the most expensive equipment ever offered to them. That in many cases the Conway has been chosen can be attributed clearly to the fact that it is technically superior to any alternative engine. This is not an idle claim: Rolls-Royce can point directly to greater thrust, lighter installed weight, lower specific fuel consumption and greater promise for the future. As a result the Conway bids fair to becoming the finest transport powerplant for the largest airliners throughout the Western world. But it is also an engine of extraordinary technical interest, and it is fortunate that permission to describe the present airline version has come when a Conway-powered aeroplane is being delivered to our global flag-carrier (see the two preceding pages).

As we have already outlined (notably in our issues of February 8, 1957 and October 30, 1959), the overall efficiency of an aero engine is the product of its thermal efficiency and Froude propulsive efficiency. What is ideally required is an engine which operates at the highest possible peak temperature and pressure ratio, yet which imparts a low acceleration to the largest possible airflow in order to minimize the jet velocity. To achieve this goal, the by-pass turbojet employs an oversized low-pressure compressor, the delivery from which is split into two distinct streams. The innermost core is further compressed in a high-pressure compressor and passed through the combustion chambers and turbine. The outer part of the delivery is discharged through a duct surrounding the rest of the engine and is finally mixed with the hot central jet in the propulsive nozzle.

Compared with a simple turbojet of the same thrust such an engine handles a larger airflow, and the lower mean jet velocity reduces the noise energy by a very wide margin. Moreover, since all components behind the low-pressure compressor can be substantially reduced in size, the engine can be made significantly lighter than the simple turbojet. Again, although the maximum flame temperature can be raised to the highest level consistent with good turbine life, the adverse effect which this has on jet velocity (from the viewpoints of Froude efficiency and noise) can be overcome by the injection of by-pass air. As a result, an engine with a carefully chosen by-pass ratio can beat any simple turbojet of the same thrust when the two engines are installed in similar aircraft and assessed on a basis of air-miles per pound of fuel.

It is recalled that Sir Frank Whittle conceived and patented the basic thermodynamic principle of the by-pass engine, and patents were assigned to Power Jets (R & D) Ltd, the Government-owned company which holds all Sir Frank Whittle's patents relating to aircraft gas turbines.

Nevertheless, it remained for Rolls-Royce to design and develop the Conway—the first, and so far the only, large by-pass engine in the world. Like most of the powerplants conceived at Derby, the basic Conway has already evolved into a complete family, current members of which give exactly double the thrust of the first prototype.

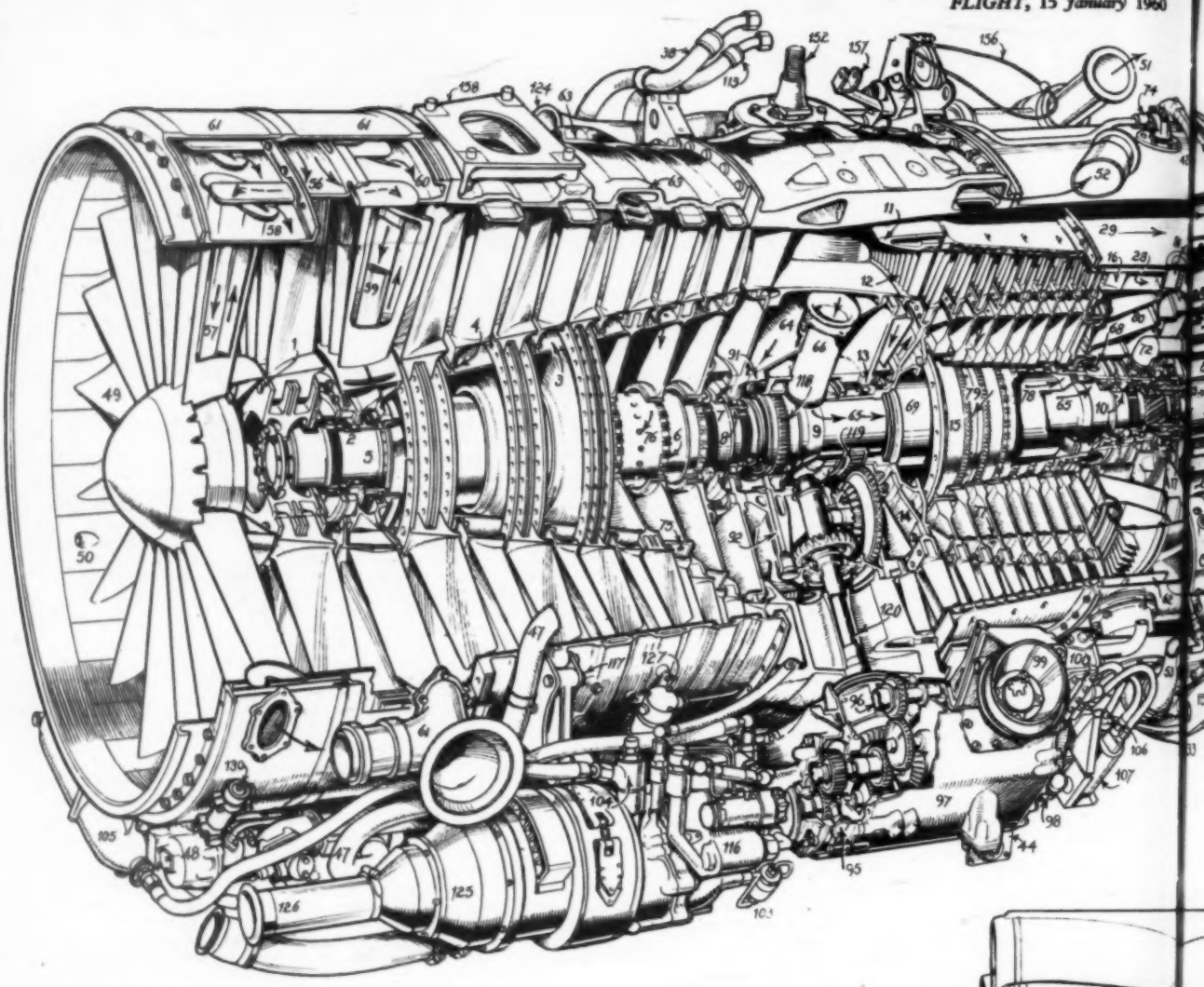
Just ten years after Sir Frank's original patent, Dr A. A. Griffith, the chief scientist of Rolls-Royce, sketched a by-pass engine built up from parts of the AJ.65 (Avon) and AJ.25 (Tweed). In April 1947 a revised version was studied, rated at rather less than 5,000lb thrust, and further projects appeared in October 1947 and April 1948. In October of the latter year Rolls-Royce decided to submit a by-pass engine to meet a Ministry of Supply requirement for a powerplant for the Vickers-Armstrongs Pathfinder (a special development of the Valiant for which the black-painted B.2 served as the prototype). Initially designated RB.80, its design thrust was 9,250lb. Considerable further development took place upon this basic design, and finally a prototype was manufactured in January 1950 as the Conway RCo.2.

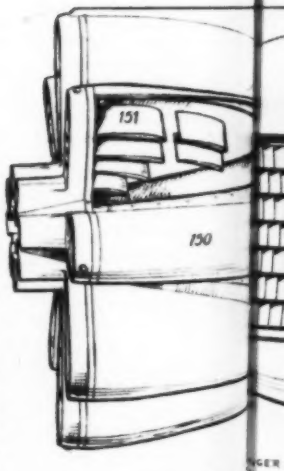
During the development of the RCo.2 it became apparent that

(*continued on page 80, after double-page drawings of Conway*)

Engine type	RCo.2	RCo.5	RCo.8	RCo.10-12	RCo.11	RCo.15	RCo.42
Configuration and design changes.	First R-R by-pass engine. Two-shaft engine, with 4-stage l-p. compressor, 8-stage h-p compressor, 2-stage h-p. turbine and 2-stage l-p. turbine.	Redesigned to higher mass flow and pressure ratio. New 6-stage l-p. compressor, 9-stage h-p. compressor, single-stage h-p. turbine and original l-p. turbine.	Conversion of RCo.5 with improvedair-cooling system to permit operation at increased flame temperature.	New design, with zero-stage on l-p. compressor, new h-p. compressor and new l-p. turbine. Completely new exterior suited to nacelle installation. RCo. 12 (uprated) succeeds defunct RCo. 10 rating.	Closely related to RCo.10/12. Tailored to wing installation, accessories not being mounted on engine but on airframe.	Increased diameter zero-stage on l-p. compressor, and improved h-p. compressor with higher efficiency.	Extensive revision to increase C/H ratio to 0.6. A completely new l-p. compressor increases overall diameter to 45in, and numerous other changes have been made.
Basic weight (lb)	3,385	3,473	3,500	4,542	Restricted	4,582	5,001
Performance:							
A, Guaranteed minimum thrust (lb)	—	—	—	17,500	17,250	18,500	20,250
B, Average achieved thrust (lb)	9,250	13,000	14,500	18,000	—	19,000	21,000
				9,980*		9,895*	9,955*
C, S.f.c. (average)	0.67	0.735	0.75	0.725	—	0.701	0.622
D, S.f.c. (cruise)	—	—	—	0.874	—	0.842	0.785
History:							
First bench run	August 1952	July 1953	January 1956	November 1957	Restricted	January 1959	—
First 25hr test	April 1953	January 1954	January 1956	March 1958	—	January 1959	—
First 150hr test	Not run	December 1954	May 1956	June 1958	—	July 1959	—
First type-test	Not run	July 1955	Not required	June 1958	—	—	—
Total bench time	133hr 52min	3,064hr	2,312hr	16,000hr	—	—	—
No of dev't engines	1	13	9 (RCo.5 converted)	—	—	—	—
Production delivery	Not produced	Not produced	Not produced	September 1958	—	Early 1961	Early 1962
First flight	Not flown	October 1955	Jan. 1957 (Ashton)	October 1958	—	1960	—
Flight time	Nil	980	2	—	—	—	—
Applications	Vickers Pathfinder	V.1000	Victor B.2	DC-8 707-420	Victor B.2	DC-8 (CPAL)	VC10 707-520

Notes: Performance A, B and C are sea-level static ISA standard day; performance D is 475kt at 36,000ft; asterisked figures are high-pressure r.p.m.





CONWAY . . .

The engine depicted in these illustrations is the Rolls-Royce Conway RCo.12 Mk 508, standard powerplant of all versions of the Boeing 707-420. As installed in that aircraft (right) the engine carries a turbo-compressor above the compressor casing, and this is not shown in the cutaway above. It is possible that en-route pressurization could be provided by bleeding at the point marked 52. At upper right is seen the reverser (flow, upper left to lower right), the doors of which are drawn in the closed position for full reverse. Previously the reverser exits were faired by doors, but these have now been deleted

*** Items so marked will be found only in the external view at lower right.**

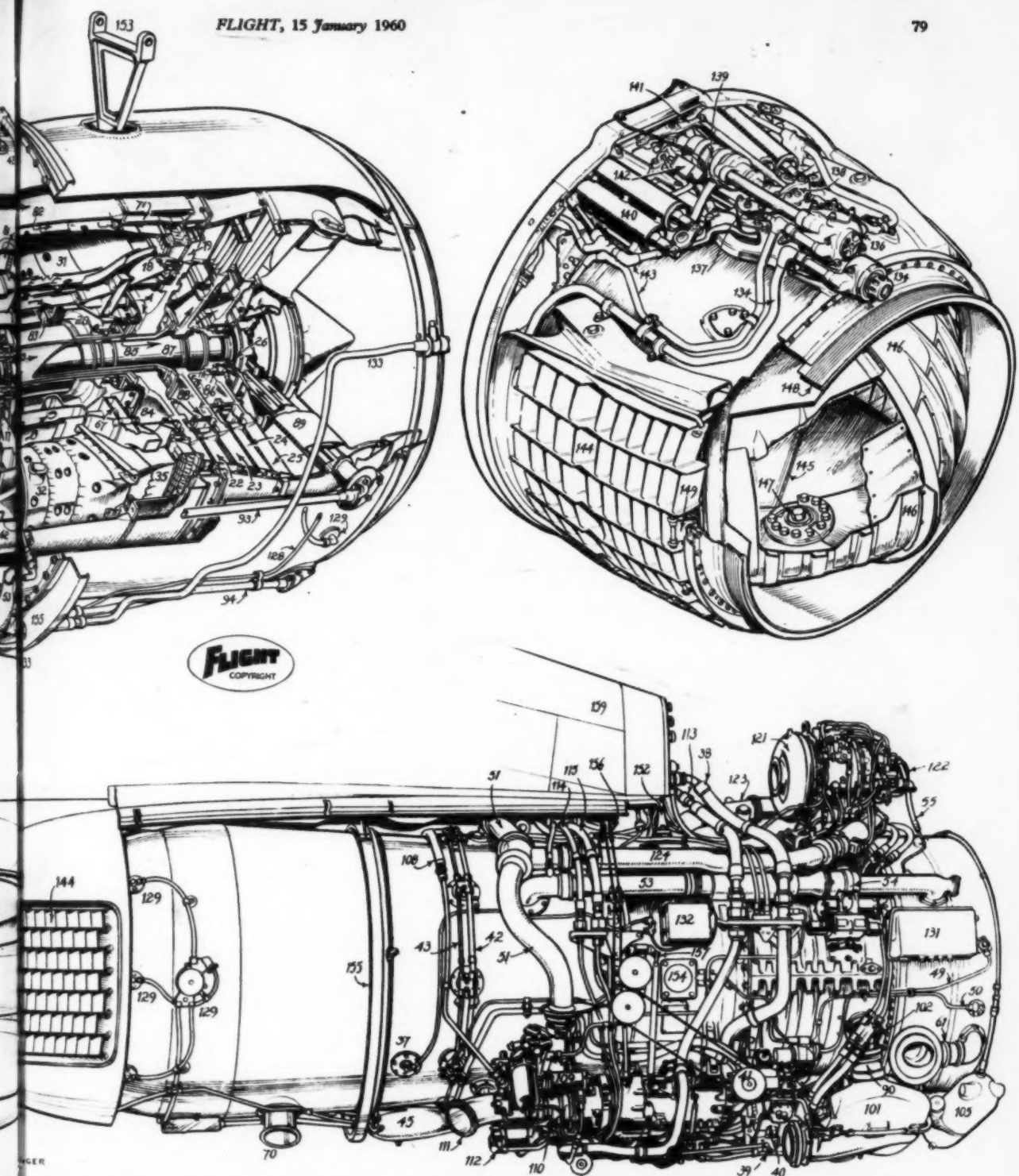
Compressors 1, blade retaining pin; 2, l-p shaft front bearing; 3, spacer ring; 4, inter-stage seal; 5, l-p shaft; 6, driving splines; 7, rotor assembly retaining nut; 8, l-p shaft rear bearing; 9, l-p intermediate shaft; 10, l-p thrust bearing; 11, by-pass duct entry; 12, h-p intake guide vanes; 13, h-p shaft front bearing; 14, h-p shaft front section; 15, h-p shaft rear section; 16, h-p outlet guide vanes; 17, thrust bearing.

Turbines 18, air-cooled h-p nozzle guide vanes; 19, air-cooled h-p rotor blades; 20, h-p turbine bearing; 21, h-p turbine shaft; 22, 1st-stage l-p guide vanes; 23, 1st-stage l-p blades; 24, 2nd-stage l-p guide vanes; 25, 2nd-stage l-p blades; 26, l-p shaft bearing; 27, l-p shaft.

Combustion 28, h-p delivery air; 29, by-pass flow; 30, combustion chamber inner casing; 31, flame tube; 32, flame tube interconnector; 33, flame tube snout; 34, flame tube support; 35, discharge nozzle; 36, fuel burner head; 37, ignitor plug.

Fuel system 38*, fuel supply pipe; 39*, h-p fuel cock; 40*, fuel control unit; 41*, throttle control; 42, main burner manifold; 43, primary burner manifold; 44, fuel pressure transmitter; 45, fuel drains tank; 46, drain-tank vent; 47, fuel-heating system air supply; 48, fuel-filter differential-pressure switch; 49, ram-air pressure to accelaration control unit; 50, ram-air tapping to altitude sensing unit.

Air systems 51, pressure air supply to aircraft services; 52, l-p air supply to aircraft anti-icing; 53*, hot air to anti-icing air-inlet manifold; 54*, anti-icing air regulator; 55*, anti-icing air to turbo-compressor (121) inlet; 56, anti-icing air supply manifold; 57, inlet-guide-vane anti-icing air in; 58, inlet-guide-vane anti-icing air out; 59, 1st-stage stator anti-icing air in; 60, 1st-stage stator anti-icing air out; 61, anti-icing air outlet collecting manifold; 62, h-p bleed-air collector manifold to aircraft services; 63, l-p bleed for engine cooling and sealing; 64, l-p cooling-air manifold (from 63); 65, l-p cooling-air to intermediate casing via tube (69) and holes (68); 66, l-p cooling-air transfer tube; 67, l-p cooling-air outlet collector duct; 68, l-p cooling-air transfer holes; 69, cooling-air separator tube; 70*, cooling-air outlet; 71, l-p cooling-air manifold surrounding nozzle box; 72, cooling-air pressure balance pipe; 73, inter-stage pressure vent between shafts; 74, thrust-housing vent; 75, inter-stage sealing-air bleed holes; 76, inter-stage sealing air via shaft to front end; 77, h-p cooling-air bleed holes; 78, h-p cooling-air flow; 79, h-p cooling-air transfer holes; 80, h-p cooling-air transfer manifold; 81, h-p cooling-air outlet to by-pass duct; 82, combustion-chamber cooling air; 83, cooling-air duct to h-p turbine; 84, h-p turbine cooling-air manifold; 85, cooling-air flow; 86, cooling-air transfer holes; 87, l-p turbine cooling-air transfer tube; 88, l-p inter-stage seal; 89, by-pass air to cool rear face of l-p turbine; 90*, l-p cooling-air to oil cooler.

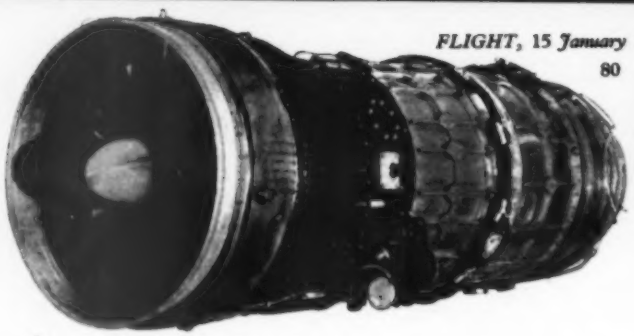


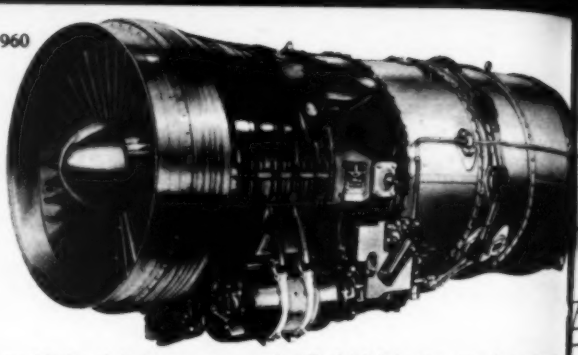
Oil systems 91, bearing oil jet and filter; 92, oil feed to accessory drive-shaft bearing; 93, turbine and thrust bearing oil feed; 94, oil return pipe; 95, wheelcase oil jet; 96, centrifugal-breather drive; 97, left-hand wheelcase and sump; 98, sump pressure filler; 99, sump gravity filter; 100, level sight-glass; 101*, oil coolers for turbocompressor (121) and CSD (116) systems; 102*, turbo-compressor oil system thermostat; 103, CSD oil pressure transmitter; 104, CSD oil temperature transmitter; 105, CSD oil tank; 106, oil pressure warning light switch; 107, oil pressure transmitter.

Accessories 108*, h-p air to starter combuster; 109*, starter combuster; 110*, starter; 111*, starter exhaust; 112*, hydraulic pump; 113, hydraulic-oil supply pipe; 114, hydraulic-oil vent pipe; 115, hydraulic-oil pressure pipe; 116, constant-speed drive unit; 117, CSD support link; 118, l-p tachometer-generator drive; 119, accessory drive gear on h-p shaft; 120, left-hand wheelcase drive; 121*, turbo-compressor for cabin air (Boeing); 122*, turbo-compressor intake; 123*, turbo-compressor delivery check valve; 124, h-p air supply to turbo-compressor; 125, alternator; 126, alternator cooling air; 127, thrust-loss indicator; 128, thrust-loss indicator pitot-head line; 129*, exhaust-temperature thermocouples and harness; 130, governor (T_1) reset unit temperature phial; 131*, exhaust-gas temperature and l-p speed control; 132*, high-energy ignition unit.

Reverser/suppressor 133, h-p air to reverser; 134, h-p air supply; 135, pressure-reducing valve; 136, control valve; 137, control lever; 138, floating lever; 139, lock ram; 140, twin-piston rams; 141, control relay lever; 142, indicator switch; 143, air distribution pipes; 144, cascade vanes; 145, front seat to clamshell doors; 146, clamshell doors shown in reverse position; 147, door pivot; 148, bellows seal; 149, expansion links; 150*, Greatrex-type suppressor; 151*, suppressor flow guide vanes.

Miscellaneous 152, front mountings; 153, rear sling point; 154*, trolley mounting pads; 155, firewall; 156, throttle control cable; 157, linkage to shut-off cock; 158, mounting pad for turbo-compressor; 159*, pylon mounting to Boeing 707.





First Conway to be built was the lone RCo.2 at left. Next stage was the RCo.5 (right), type-tested in 1955

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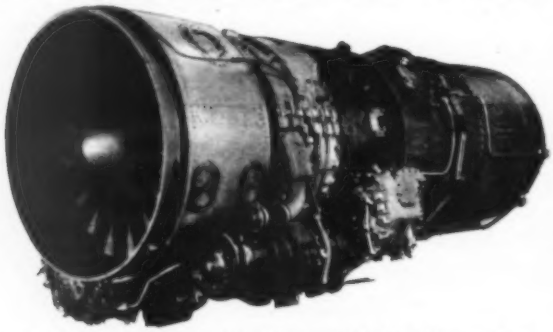
an even higher level of thrust was likely to be demanded for the propulsion of a projected Vickers military jet transport (which later became the V.1000). As a result only one RCo.2 was built, and A. A. Lombard, director of engineering (Aero Division), has commented wryly: "It must have known that it was to be superseded, as it behaved perfectly for the whole of its 133hr life." In fact, 10,000lb was achieved on the bench in January 1953.

As might be expected the lone RCo.2 broke new ground in many respects. It was by no means the first Rolls-Royce two-shaft engine, but it was the first to run at Derby with tandem axial compressors, and it was also the first to be designed to employ air-cooled turbine rotor blading. Previously, initial exploration had been conducted with a hack Avon RA.2 with fabricated air-cooled blades, but from the outset all Conways have been fitted with air-cooled blading in order to permit the employment of a higher flame temperature.

Although the next development stage was the 11,500lb RCo.3—the design of which was started in January 1952, before the RCo.2 first ran—it too was overtaken by the inexorable demand for more thrust, and it was uprated to 13,000lb thrust and redesignated RCo.5. Compared with the RCo.2 this unit incorporated an entirely new compressor, handling a much greater mass flow and



The RCo.11 for the Victor B.2 is distinguished by its bore exterior

working at a higher pressure ratio; the high-pressure turbine was redesigned with only a single stage of blading and almost every part of the engine was re-engineered. The first RCo.5 ran in July 1953, and in August 1955 one of the thirteen engines built to this standard passed a type-test at a dry rating of 13,000lb. This stage was reached in eight distinct steps spread over five years from the original RB.80. The RCo.5 was undoubtedly a fine engine upon which to build, for at the time of its type-test its dry rating was higher, and its specific consumption lower, than that of any other type-tested engine in the world.

In November 1955 the V.1000 was cancelled. Nevertheless the RCo.5 engine appeared to be a suitable basis around which could be designed an improved mark of the Handley Page Victor, and an uprated version designated RCo.8 was proposed to the Ministry of Supply forthwith. Mechanically the two engines were virtually identical, apart from the 8's more efficient air-cooling system which permitted the flame temperature to be raised by a significant margin. In January 1956 the first RCo.5 converted to RCo.8 standard was run on the bench, and a rating of 14,500lb was soon established. However, the old story was repeated: as the weight of the Victor B.2 grew so did the thrust demanded, and the RCo.8 was already a hot engine by 1956 standards.

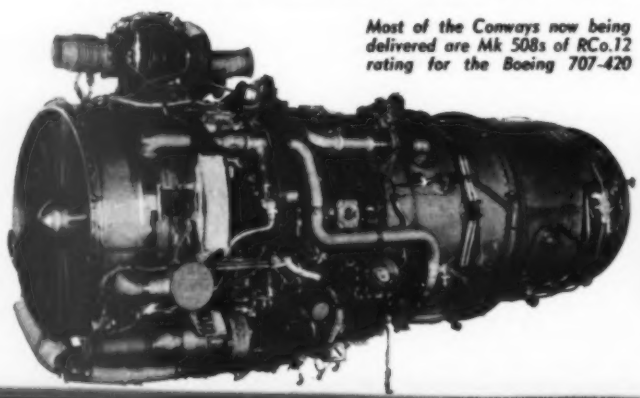
During the opening months of 1956 it became clear to the engineers at Derby that further enlargement of the Conway was inevitable. This fact has proved to be the salvation of the engine, and has enabled it to challenge the largest American turbojets as powerplants for the greatest airliners in the world. What really triggered off the bigger engine was the visit to Derby of J. T. Bain, director of engineering and maintenance for Trans-Canada Airlines, during which he expressed his company's keen interest in the Conway as a powerplant for their intended big jetliners. (TCA deserve special mention in this context, since their courageously complete reliance on the Viscount was instrumental in establishing that aeroplane in world markets, while their future fleet of Viscounts, Vanguards and DC-8s will be the largest in the world powered entirely by Rolls-Royce turbines.)

The TCA team suggested that a rating of 15,000lb would be adequate for the version of the DC-8 which they intended to purchase, and that this thrust would also make the Rolls-Royce engine competitive with the Pratt & Whitney powerplants around which both the DC-8 and Boeing 707 were originally designed. With remarkable speed a largely redesigned Conway with this rating was committed to paper, and was then used as a basis for discussions with Boeing and Douglas themselves. As a result of the latter, and adhering to the proven company policy that excess power is quickly swallowed up by the natural growth of a new aeroplane, the RCo.10 design was sized at an average rating of 16,500lb (16,150lb guaranteed minimum).

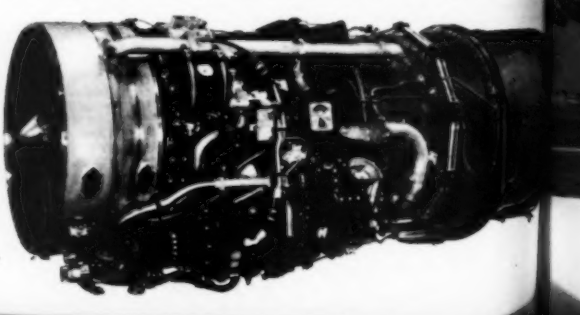
Meanwhile, the firm military requirement for the Victor B.2 powerplant remained. It was obviously desirable to go into production with military and commercial Conways which were substantially identical, and accordingly Rolls-Royce investigated means whereby the increased thrust might be achieved within the rigid confines of frame envelope diameter imposed by the need to bury the military engine inside the Victor's wing. The latter fact appears, in retrospect, to have been responsible for the choice of a by-pass ratio which, at 0.3, is slightly below the optimum. What was actually done was to add a zero stage to the low-pressure compressor to increase the pressure ratio and mass flow, while an entirely new high-pressure compressor was designed with ten per cent greater capacity. The latter was necessary to return the by-pass ratio to its former value, and to hold the flame temperature at a level below that accepted for the RCo.8. At the same time a new low-pressure turbine was designed, with increased diameter.

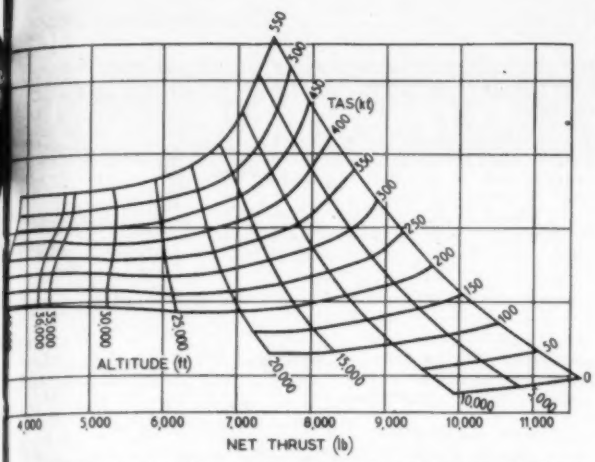
By the summer of 1956, the future for the Conway had been clearly charted. The basic rating for the new engine would be 17,500lb. Initially, however, the commercial RCo.10 would be rated at 16,500lb and—merely by recalibrating the fuel control—would be released for service at the full rating after about a year of scheduled operation. The military engine would be rated at 17,250lb, and after discussions with the Ministry of Supply this figure was accepted as the RCo.11. [*Continued on page 81*]

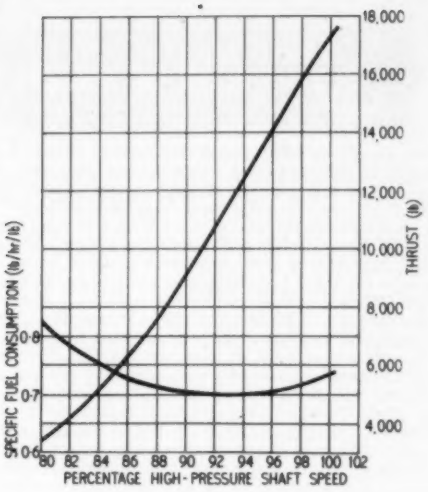
Most of the Conways now being delivered are Mk 508s of RCo.12 rating for the Boeing 707-420



Although basically identical to the Boeing engine, the Mk 509 for the Douglas DC-8 is superficially quite different in appearance







ISA standard-day performance for an RCo.12 with reverser and silencer. Above, the carpet of performance at 93 per cent h-p. speed; right, average sea-level static performance, without intake losses

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Internally, there is virtually no difference between the military and commercial engines. Externally, they are as alike as chalk and cheese. The RCo.11 is mounted inside the wing of the Victor, and so virtually all the airframe accessories are carried on the airframe. In contrast, the airline unit is hung in a streamlined nacelle on the end of an underwing pylon. For the simple reason that there is nowhere else to put them, all the airframe accessories accordingly have to be mounted on the engine itself. It may not be apparent that the work involved in draping a dense mass of auxiliaries and accessories around a bare carcase consumes considerably more man-hours than does the rescaling of an engine itself. An indication of the strength of Rolls-Royce, if such were needed, is provided by the fact that from the start of design of the RCo.10 to delivery to Douglas Aircraft took but 25 months.

The first of the new family of Conways started bench-running in November 1957. Since that date 16,000 bench hours, including 16 150hr tests and three 1,000hr runs, have been logged, and as a result of the outstanding behaviour of the engine Rolls-Royce decided last summer that it would not be imprudent to recalibrate all RCo.10s to the RCo.12 rating forthwith. The RCo.10 rating is therefore defunct, and all users of the Conway have been presented with a dry thrust of 17,500lb from the outset. In fact, the thrust figure which appears on the certificate issued a year ago—awarded as a result of a type-test in June 1958 to the combined US/UK schedule—is 18,000lb. The value of 17,500lb is a guaranteed minimum performance, and the average figure now being achieved by engines being installed in 707-420s and DC-8s is 18,000lb. A further advantage to operators in low-temperature ambient conditions is that thrust is allowed to build up freely, to a limit of 19,000lb reached at low ambient conditions. It is appropriate now to describe engines of this type before once more picking up the thread of development.

Practically all the major design choices may be discerned by reference to the cutaway drawing. Dealing first with the main rotating assembly, the low-pressure compressor employs six stages of aluminium-alloy blades and a seventh stage of titanium blades. The high-pressure spool has seven stages of titanium blades and two final stages of steel. All rotor blading is pinned to steel discs which for centering purposes are hairpin-located on the forged-steel shafts (a principle developed with the Avon, described in our issues of December 16, 1955 and October 11, 1957).

All three turbine stages employ ferritic discs and the high-pressure blading incorporates internal air-cooling passages. No details may be published of how these blades are manufactured. All turbine rotor blading is designed to a mixed impulse/reaction form, and all blades have extended roots and tip shrouds.

The complete high-pressure system is located by three bearings. The shaft is split in the centre, the front and rear portions being joined through a coupling with helical splines (23° angle) to counteract the parting load so that only a very small stop is required to hold the two sections together. Axial location is provided by a central ball thrust bearing, the end-load on which is reduced near to zero by adjusting the pressure on the end discs of the compressor and on the turbine. A similar arrangement is employed to carry the low-pressure assembly, although in this case the angle of the helical spline is but 16° 34′. As might be expected, the zero-stage on the compressor is overhung.

In general the Conway carcase is conventional, apart from the construction of the by-pass duct and the manner in which fabricated steel has replaced cast and machined construction. In the current RCo.12 the front end is largely of light alloy, the low-pressure casings being of aluminium alloy and the intermediate casing and wheelcase being of magnesium. The inlet guide vanes and zero-stage stators are anti-iced by hot air, and are accordingly fabricated in steel. The remainder of the low-pressure stators are of aluminium alloy, but all the high-pressure stators are steel.

The front-bearing housing, high-pressure compressor casing, compressor outlet casing and combustion-chamber casing are all fabricated in steel. The combustion chamber is of the can-annular type, there being ten flame tubes (see sketch, p. 82). Particular mention should be made of the by-pass duct, which is entirely butt-welded in titanium sheet. Very extensive rig-testing determined this form of construction for a component which must

It was TCA's order for Conway-powered DC-8s which put the engine on the airline map. These aircraft enter service in April

The airline Conway is fitted with a noise-suppressing nozzle. In the 707-436 (illustrated) this is of Rolls-Royce design

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withstand exceedingly high and varying internal pressure loads at relatively high ambient temperatures; moreover, the duct has to withstand 150 per cent of the maximum thrust of the engine as an axial load when the reverser is in operation.

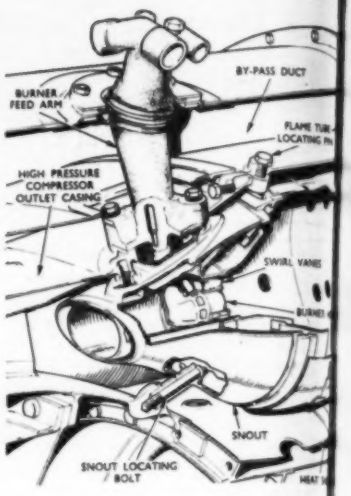
Rolls-Royce designs of thrust reverser and noise-suppressing nozzle have already been described (*Flight*, September 19, 1958 and February 6, 1959) and are illustrated on pp. 78-79. Joseph Lucas (G.T.E.) Ltd designed the fuel system, which is generally conventional. Most standard turbine fuels can be accepted and the system is entirely automatic in operation. Unlike corresponding American engines the pilot does not have to set up the engine according to airfield, altitude and temperature in order to produce the required thrust, but merely pushes the power levers as far forward as they will go in the knowledge that the maximum possible thrust will thereby be obtained (up to the cold-weather limit of 19,000lb). The oil system is self-contained and includes a fuel oil heat exchanger. Air sealing and cooling is conventional, although it is worth noting that, in order to provide air at the required pressure, the cooling flow for the turbine discs is tapped off at about 400°C from the inner combustion casing.

For the Boeing 707-436 (BOAC) and its sister-ships in other airlines, accessories are disposed as shown in the main drawings on the centre pages of this issue. The Sundstrand drive incorporates its own oil system and cooler, and an auto-tensioned cable/pulley system is used to control engine power. Aircraft pressurization is handled by an AiResearch turbo-compressor driven by bleed air. As an alternative, a bleed from the outside of the low-pressure compressor casing could be employed during the cruise (the Caravelle is at present pressurized by air bled from the inside of the Avon compressor). The DC-8 engine is generally similar, except that the turbo-compressor units are relocated in the nose of the aircraft and that the low-pressure fuel system includes a flowmeter.

For the 707, Rolls-Royce deliver the complete powerplant, including cowling, reverser and suppressor. For DC-8s bare engines are delivered. The Boeing nacelle comprises a nose cowl and enormous side doors, which can be opened for major servicing but incorporate small apertures for such tasks as filling the oil sump. These doors are hinged to the upper "mid fairing" which, although made by Rolls-Royce, bolts permanently to the bottom of the Boeing pylon and marks the joint between powerplant and airframe. The engine is suspended by a pair of spigots above the intermediate casing, one of which takes thrust and the other (being spherically mounted) takes weight only. The resultant yawing load, and a proportion of the weight, is borne by the rear suspension above the nozzle box. The majority of connecting services are grouped at a disconnect platform on the starboard side of the compressor casing. In most installations a low-pressure air or combustion starter is used.

The next stage in development is the RCo.15, which can readily be converted from RCo.12 standard at an overhaul. As well as incorporating a large number of minor cleaning-up modifications to improve the specific consumption, the RCo.15 has a new front end, fabricated entirely in steel and with a slightly increased diameter. The zero stage has increased capacity to handle the mass flow of 295lb/sec, the inlet guide vanes and zero-stage rotor blades are lengthened and the first-stage rotor blades have a slightly changed angular setting.

This detail sketch of the forward end of a combustion chamber clarifies the mechanical and aerodynamic design. Typifying modern Rolls-Royce/Lucas practice, each of the ten cans is fabricated from nimonic sheet



Ultimate development of the Conway is aimed at raising the by-pass ratio to a level giving optimum specific consumption in high-subsonic cruise conditions. Engine diameter has grown to some 45in.—which can readily be accepted in a nacelle-type installation, and is in any case 9in less than that of the Pratt & Whitney JT3D—and the by-pass ratio has been raised from 0.3 to 0.6. The greatly increased mass flow of 363lb/sec and other changes have resulted in a considerable increase in thrust, matching the engine to the Vickers-Armstrongs VC10, as the Conway 540, and allowing Boeing to offer an even larger 707. It is worth noting that the complete high-pressure rotating assembly is exactly the same as that in the present engine, and it is expected that this critical unit will have logged nearly 2,000,000hr in airline service, as well as additional time with Bomber Command, by the time the RCo.42 enters service.

In many respects the RCo.42 has developed in parallel with the RB.141 and 163, this being particularly the case in the careful matching of hot and cold flow-velocities and the mixing of these streams in the final nozzle to obtain the last iota of installed efficiency. Rolls-Royce are confident that the RCo.42 cannot be beaten within the time-scale of its development, and even more advanced Conways are planned to succeed it.

THE ORDER BOOK

Military: The RCo.11 is currently in production for the Handley Page Victor B.2 bomber for the RAF. No indication of the number of aircraft may be divulged.

Civil: The RCo.12 (Mk 508) is being delivered for installation in Boeing 707s of BOAC (15 707-436), Air India (3 or 4 707-437), Lufthansa (4 707-430) and Varig (2 707-441); the RCo.12 (Mk 509) is being delivered for installation in DC-8s of TCA (6) and Alitalia (4); the RCo.15 has been ordered for installation in the DC-8s of CPAL (4); and the RCo.42 (Mk 540) is being developed to power the VC10 aircraft of BOAC (35).

RCo.12 BASIC DATA

Dimensions: Maximum carcase diameter 42.2in; length of bare engine 135.9in; internal diameter at intake 37.6in.

Performance (ISA standard day): Guaranteed minimum rating 17,500lb, average fleet rating 18,000lb at 9,980 r.p.m., with mass flow of 282lb/sec; corresponding specific consumption 0.725; typical cruising thrust at tropopause at 475kt, 4,625lb; corresponding specific consumption 0.874.

Although precise evaluation under altitude conditions is being conducted in the company's high-altitude test plant ("Flight," October 3, 1958) intensive flying is being conducted with an Ashton and with the Vulcan shown here. The Vulcan has frequently flown 18hr daily

Straight and Level

AMAZING how the various flying clubs have different ideas on what to do with members' time when they're not flying. Some have pretty impressive bar sales, some race Go-Karts, some go in for theatrical activities, and so on. Now what do you suppose is the main preoccupation of the club with the following diary?

Jan. 10, Hot-pot dance. Jan. 17, Hamburger dance. Jan. 24, Cornish Pasty dance. Jan. 31, Hot-pot dance. Feb. 7, Buffet dance. Feb. 11, Wine and Cheese party. Feb. 14, St. Valentine dance with Hot-potato and Brisket supper. Feb. 21, Chicken Barbecue dance. Feb. 28, Hot-pot dance. Mar. 1. Social evening with Hot-pot supper. Mar. 7, Buffet dance. Mar. 21, Beer and Bangers dance. Mar. 28, Pie and Pickles dance. Apl. 4, Edwardian dance with Salad Supper.

That was how they began 1959, and the same singleness of purpose continued throughout the year, reaching a climax in December with a Hot-pot supper dance on the 5th, children's tea party and adults' Hamburger supper on the 19th, and a Turkey and Pork supper on the 31st. No prize for guessing, after all those mentions of hot-pot, that the gastronomicists belong to Lancashire Aero Club.

Bicarbonate of soda, anyone?

● The Comet 4's Flight Manual has a section dealing with the two-engines-out overshoot case. The section reminds pilots to *reduce* power to keep the speed within limits (i.e., flap and undercarriage structural limits) during the climb-out. This—repeat—on two engines. Could there be a more remarkable illustration of the Comet 4's great reserve of power?

How about this one, then—the story (perhaps apocryphal, but a good one all the same) of how the Comet's instrument panel got its power-loss indicators.

A certain esteemed check pilot did a take-off in the course of the Comet's test programme, one of those typical steep-climbing take-offs for which the Comet has subsequently become so well known. "What about that for a three-engined take-off?" called a certain esteemed DH test pilot. Came the reply: "Three engines? I didn't know we were doing that on only three engines . . . I think we'd better have power loss indicators in this aeroplane."

* * *

I wonder that BOAC's publicity boys don't plug the power aspect of the Comet more than they do. It is, to my way of thinking, the Comet's greatest asset. How about prominently advertising, good and big, the figures 0.26, with the accompanying text: *"This is the power ratio of the Comet 4, the jet airliner with a greater reserve of power than any other."*

It would sell tickets, and no rival—however weak the spot this touched—could argue with it.

● I quote from the SBAC News Letter: "There is strong evidence to show that the demand for turbine airliners will grow fast: The British aircraft industry not only has the aircraft to cater for practically any airline requirement, but unrivalled experience in design, construction, operation and after-sales service."

Wouldn't it be nice if all this were true, and not just some of it?

● I recounted last week the tribulations of a friend under the Kenya Immigration Regulations. I am now happy to give another side of the picture in these extracts, which have just come my way, from official minutes passing between members of H.M. Customs:—

Customs, Dover, 25 July 1909

Hon Sirs,—I have visited the spot where he [M. Bleriot] landed at 6.30 a.m., and got into conversation with an individual largely interested in the Wright aeroplane who gave it as his opinion that although airships will never come into commercial use, there are great possibilities in store for them, and I think that a time may come when this Department will have to treat their arrival seriously, and take steps to ensure that no opportunity be given for Revenue interests to suffer through indiscriminate landings of airships in this country.—Respy, A. S. WILLIAMS, Collr.

Surveyor, H.M. Customs, Dover,
The Collector *27 July 1909*

Sir,—On the arrival of the Monoplane from Calais, the Prev man in charge interviewed M. Bleriot. and issued to him a Quarantine Certificate, thereby treating it as a yacht, and the aviator as master and owner.—Your obedient servant, P. M. JOHNSON.

Customs, Dover, 27 July 1909

Hon Sirs,—Some three weeks ago, when the question was first mooted, I gave instructions to the Surveyor that the crossing of the Channel by airship was not to be treated officially by our officers, as I considered that an attempt to impose Customs regulations on anyone engaged in experiments with aerial navigation would only tend to bring this Department into ridicule without doing any practical good.

I now find that an officer, doubtless carried away by the excitement of the moment, failed to carry out these instructions. . . .—Respy, A. S. WILLIAMS, Collr.

After half a century this col respy doffs its hat to A. S. Williams, Collr.

● People get so excited about new structural techniques. Sculptured skins, honeycomb-stabilized panels, functional designs like that of the Northrop Freedom Fighter, or polymorphic configurations *à la* Wallis all thrill them.

But show them the same kind of ingenuity in a new light aircraft and they groan. It will break, it will be hell to maintain, it will not stand hard wear, it is too tricky or expensive to manufacture. Give them the last word in conservative conventionality every time.

Why? Can you show me a really new or unconventional light aircraft structure or design which has made the commercial grade during the last ten years—or even since the Wright brothers? There are precious few, if any.

● At the recent safety symposium P. G. Tweedie of the MoA referred to a pre-war German "crash-cause detector" which comprised a brick with six holes drilled in it. Each hole was blocked by a fire-resistant membrane, and represented some vital accident cause—e.g., "No. 1 engine on fire." The idea was that, before crashing, a crew member grabbed the brick and burst the appropriate membrane with his finger.

All that the investigators had to do was to find the brick. Of course, as Walter Tye of the ARB commented, there had to be a hole for "I have no idea what's wrong."

Those Squares at Sperry

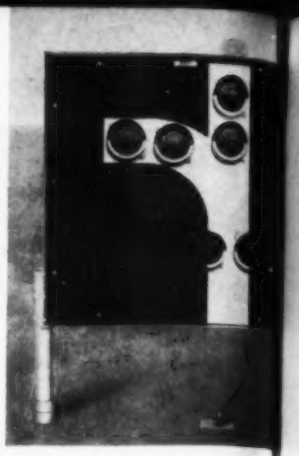
● Extract from Airlines Electronic Engineering Committee report on "Meeting on the standard ARINC air transport indicator":—

"The Marman Company had not been able to build a single model of clamp to fit the multiple ARINC standard . . . and the Sperry round-cornered square with curved sides."

ROGER BACON

This is how the artist sees "Australia" in the *avant-garde* calendar sent out by the French airline TAI. I thought the marsupial had had its whole day spoilt for it by some cad from Woomera armed with a Malkara until I noticed that the missile was that koala on the right there—apparently contemplating launching out on a reciprocal

FLIGHT SYSTEM SURVEY



The new General Electric taxi route indicator. The lower pair of red lights may be lit to stop the aircraft and the pairs of white lights will show the way. The plastic board is 3ft square and the legs are weak to avoid damaging aircraft. Lights are remotely controlled from the tower and the 6V lamps may be changed with the circuit live

FAA Report on Decca

PRESS reports from Washington and New York last week referred to some outspoken criticisms following an evaluation of the Decca Navigator system, presumably using the mobile chain in the New York area. The reports were apparently derived from a preliminary statement issued by the FAA in advance of the report itself, and it is not at all clear what kind of trials are described, nor what the criticisms imply.

The New York Airways helicopter evaluation, and parallel tests with a single FAA Bell 47 should by now have been completed and the report may refer to these. Another trial was run during last year when about a score of representative business and private pilots were asked to navigate a cross-country flight in the FAA Bell using Decometers alone. Bell themselves have installed Decca for experimental helicopter flying using a mobile chain at Fort Worth. The US 7th Army in Germany has fitted Decca in about 30 cargo helicopters and has successfully used the system for more than a year. The only official report so far issued has been the preliminary findings of New York Airways stated during the ICAO special meeting in Montreal last February. The Council meeting to ratify the decision to support VOR is due soon.

C.M.C. Doppler Performance

HAVING completed 2,000hr in Boeing 707s, the Canadian Marconi CMA-623 Doppler radar is giving excellent results and the company guarantees the brochure performance. The Doppler operates at heights from 40-40,000ft over diverse reflecting surfaces and one unit has been closely observed by an independent body while operating over a smooth lake during a controlled climb from 40 to 10,000ft. Experience has shown that an accuracy of 0.6 per cent of total distance flown is normal and the recent evaluation by Qantas produced maximum errors of between 7 and 13 n.m. after flights of over 3,000 n.m. Maintenance reports indicate that the average time between failures, in normal airline use, is about 700hr. Other reports show that reductions in flight time of 5 per cent are within reach when using Doppler as the prime navigational aid. Even over very smooth water, contact with the surface was maintained from 42,000ft for 98% of the time.

Boeing 707 Search Radar

THE Ekco type E.160 search radar as fitted in all Comet 4s at present in service is also installed in BOAC Boeing 707s. An X-band equipment with a range of 120 miles, the E.160 incorporates a combined pitch and tilt stabilization system which operates up to $\pm 25^\circ$ in pitch and $\pm 45^\circ$ in roll. The scanner sweeps 90° either side of the aircraft centre-line. Pencil beam or equal-energy-distribution beam, respectively for weather or map painting, can be selected and the overall installed weight of the complete equipment is about 340lb.

FLIDEN for ATC Automation

FIVE examples of the new flight data entry units made by the Aeronutronic division of Ford Motor Company have now been delivered to the FAA experimental centre at Atlantic City. Called FLIDEN, the new equipment is designed as a semi-automatic means of producing flight-plan information in a form suitable for automatic handling in the Data Processing Central. Units of the Central itself are now being delivered to Atlantic City for initial testing.

Each FLIDEN console contains a magnetic drum for storage and read-out, flight plans being recorded in a fixed format. As the details are inserted on a typewriter keyboard in a fixed order the format and inserted information appear on a special cathode-ray tube so that errors may be detected. The machine may be back-spaced to any point for correcting one or more characters, and can then be returned to the proper point for continuation of the flight plan. Only ordinary typing skill is required.

Lear Miniature Horizon

A NEW miniature, remote-operated attitude indicator with a 2in dial has been developed by Lear Instrument Division. Designed for installation as a stand-by to integrated instrumentation in military or civil aircraft, the new attitude indicator is controlled by a remote miniature vertical gyro which can additionally supply attitude signals to three other aircraft systems. The gyro is fully free in roll and up to $\pm 85^\circ$ in pitch. A rate gyro cuts off the erection system of the vertical gyro during banks of more than 15°. The indicator is driven by two identical servo loops in self-contained modules and the dial face is treated to avoid unwanted reflection and provided with internal lighting. The presentation is in the form of a globe painted grey for sky and black for ground and provided with expanded pitch graduations to increase legibility. The fixed aircraft image can be electrically moved 10° nose down or 20° nose up.

The system may be operated direct from a 115V single-phase a.c. supply or a transistor power unit can be added to produce this supply from a 28V d.c. source. Automatic changeover may be arranged or standby batteries can be carried to make it completely independent of aircraft power. Lear have produced more than 35,000 vertical gyro indicating systems during the past eight years.

Systematic Visibility Measurement

TESTS have now begun at the FAA experimental centre at Atlantic City to provide pilots with approach light contact height (ALCH) and runway visual range (RVR). ALCH is the point on the standard glide-path when the pilot can expect to see the high-intensity approach lighting leading to the runway, and RVR is the distance he can expect to see along the runway. US Weather Bureau teams have been experimenting in these techniques for some time at Newark Airport and RVR measurements have been available to tower controllers at Newark, Washington, Idlewild, New York, Boston, Los Angeles and Fort Worth.

ALCH measurements are made with a transmissometer, a rotating beam ceilometer and an illuminometer or light meter and related to the intensity setting of the approach lights. The information is given to the pilot as he passes the outer marker. Later this year an electronic computer will be introduced to compute and display ALCH values, replacing present manual computation. A computer is also to be supplied for automatic calculation of RVR.

Lockheed Electronics Subsidiary

FOLLOWING acquisition of Stavid Engineering Inc by Lockheed Aircraft Corp a new Lockheed Electronics Co is being formed from a Stavid Division at Plainfield, NJ, and a Newport Division at Newport Beach, Cal. A new research and manufacturing centre is being built at Newport Beach to serve as the headquarters of the Newport division, which will also include the former Lockheed Electronics and Avionics Division in Los Angeles. Similar expansion is proposed for the Stavid Division.

The main purpose behind the formation of the new company is the expansion and particularly diversification of Lockheed electronics interests, with special emphasis on civil sales. Stavid, with 1,000 employees, has hitherto specialized in military airborne and shipboard radar, anti-submarine warfare research and development, fire-control systems, missile guidance, field engineering and simulation and automatic checkout equipment. David F. Sanders, formerly president of Stavid, is to be president of Lockheed Electronics Co.

Pinetree Chain Extension

THE line of radars stretching across Canada known as the Pinetree Chain is to be extended by an additional 45 stations to ensure detection of aircraft flying below 2,000ft. Two-thirds of the cost of the new equipment is to be borne by the US and the remainder by the Canadian Government. Pinetree Chain was established about eight years ago and extends from Vancouver Island to Dawson Creek, British Columbia, and from Winnipeg to the Canadian east coast. Arrangements have already been made for the construction of seven new stations in central and western Canada. Pinetree is the central radar chain, with the Dewline in the far north of the McGill Fence close to the US-Canadian border.

Cessna models for 1960, four of which are illustrated on this page, feature swept fins and rudders. Above left, the Skylane (luxury version of the 182) is powered by a 230 h.p. Continental O-470-L and costs $17,325. Above right, the 310D (two 260 h.p. Continentals with fuel injection) cruises at 220 m.p.h. and has a single-engine rate of climb of 440ft/min at 4,830lb gross weight. Price is $59,950

Sport and Business

SOME WEEKS AGO we suggested on this page ("Air Traffic in the Tinderbox Age," December 11) that the time had come for an overhaul of the way in which legislation is presented to the private pilot. Among the ideas put forward were those of a new preface to *Air Pilot*, dealing only with those matters that concern the conduct of flight clear of airways; a ready reference to airfields where private pilots can land without prior permission; a guide to the steps to take to obtain information about the weather, about position-fixing or about finding the way home; and a simple reference to radio aids that would be of direct use in the limited cockpits of private and business aircraft. These suggestions were made in the belief that the development of British private and business flying depends almost as much upon the introduction of suitable radio and navigation equipment as it does upon new aircraft. There are new techniques for the private pilot to learn and the sooner they are acquired the sooner will come a resurgence of private flying in the British Isles.

Not many pilots may know of the HMSO publication *Radio Facilities Charts, United Kingdom*, in many ways an ideal reference for carriage in radio-equipped light aircraft. The charts are to be commended as being pared of all but essential radio navigation information. They cover all aeronautical radio stations in the British Isles and contain in an appendix extracted from *Air Pilot* a list of aerodromes and radio services available. Another appendix —which the private pilot may find more of academic interest than of practical value during a flight—shows *en route* communication coverage provided by the VHF R/T multi-carrier and route cover systems. *Radio Facility Charts* is readily available and a good 5s companion for any flight.

If an improvement could be suggested it is that another, simplified edition might be prepared to meet the practical needs of the man with only a VHF communication set and an ADF. In this case VDFs and NDBs would be given greater prominence and the charts could be simplified by omitting the VOR, ILS and fan marker facilities that few private pilots yet have the equipment to receive.

This is not such a retrograde step as it might appear. In the use of radio aids, private flying in this country has fallen a long way behind its American counterpart; if it is to catch up it must start from the very simplest of primers.

A LONDON - CARDIFF AIR RACE on June 4-5 is included in a provisional calendar of 1960 events published in the January issue of the *Royal Aero Club Gazette*. Other provisional dates are June 17-18, air touring competition; and July 17, air rally at Woburn Park. A definite fixture is the Popular Flying Association rally at Cranfield on September 10-11.

600 (CITY OF LONDON) SQUADRON FLYING GROUP have reported an extremely active year's operations for 1959. Target flying-hour totals of 300 for the group's Tiger Moth and 150 for the Prentice were handsomely beaten, and the Prentice—"booked solid from May to September"—logged an impressive number of touring flights to the Continent and North Africa.

GLIDING EVENTS FOR 1960 include two national gliding weeks (at six sites) and an Easter weekend rally at the Midland Gliding Club site at the Long Mynd, Shropshire. Organized jointly by the British Gliding Association and the local clubs, the first national week will be from May 28 to June 6. Open meetings will be held at Perranporth (Cornish G.C.), Tebay Gill (Lakes G.C.) and Portmoak (Scottish G.U.). For the second week, July 24 to August 1, the sites of the Yorkshire, London, and Derbyshire and Lancashire clubs at Sutton Bank, Dunstable and Camphill respectively have been chosen. The British Gliding Association's annual ball will be held on Friday, March 11, with the association's annual general meeting and instructors' conference on the following day.

RETROSPECT

From "Flight" of January 15, 1910

Discontented Spectators in Algiers: On the 9th inst., Oleslaegers was announced to give some exhibition flights at Oran, Algiers, but the spectators were dissatisfied with the two short trials which were made, and showed their displeasure by breaking down the enclosures and making a raid on the buffet. Eventually order was restored by the military. On the following day the aviator flew for about 6 mins. at a height of 80 metres, and was loudly cheered by the crowd, while on Tuesday he flew for 54 mins., during which he made a wide sweep over the town of Oran.

The only high-wing Cessna to have retractable landing gear is the Model 210 (left), which cruises at 190 m.p.h. on its 260 h.p. Continental and costs $22,450. Right, luxury version of the Model 175 has been named Skylark (engine, 175 h.p. Continental GO-300-C; aircraft price, $13,050). The landplane version cruises at 140 m.p.h. and the floatplane model at 110 m.p.h.

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Boeing 707 Take-offs

OPENING my bleary eyes on New Year's morning I found to my surprise that my letter concerning Boeing 707 take-offs had been printed by your esteemed magazine, for which many thanks.

I feel that your contributor John Stroud has been rather harsh in the footnote to my letter, for I did refer to my doubts about the term runway length required, under the paragraph headed "Rome-Cairo," though I must admit I did not make this clear in later paragraphs. However, ignoring for the moment all my other comments on field lengths required, I should like to re-examine the take-off from Nadi. I have obtained some details about the balanced field length required by the 707-120 at the maximum take-off weight involved. Reference *Flight*, November 20, 1959, page 582: Balanced field length for 707-120 at max t.o.w. ISA at sea level = 10,200ft. Temperature correction (reference page 738, *Flight*, November 7, 1958): Recommended increase in balanced field length = either 1.8 per cent per 1°C above ISA or 1.0 per cent. Airfield temperature = 21°C, i.e., ISA + 6°C. Therefore, balanced field length for max t.o.w. at 21°C = either *circa* 11,300ft or *circa* 10,800ft, in zero wind and ignoring altitude effect. Thus the field length required quoted (i.e., 10,500ft) implied that a fairly strong wind must have been blowing in the favourable direction.

My claim about the marginality of the take-off in this case is based on the fact that the safety regulations were only just met, and that if the temperature had risen by 1°C, or the wind had slackened during the take-off, the aircraft would have been operating outside the safety regulations governing balanced field length.

I also refer Mr Stroud to *Flight* for December 25, 1959, page 798, for further information about the marginality of certain 707 take-offs.

Answering two of your contributor's other comments, I make a contrary suggestion, that a major reason for the large orders for the 707 and DC-8 is the quality competition brought about by the fare-fixing policy of IATA. With all respect to Boeing, I'm sure that any confidence expressed in the 707 could not have been caused by the commercial-aircraft record of the builder, which amounts in post-war days to less than 50 ageing Stratocruisers, few of which are now in service with major airlines.

I also stick to my comment *re* a turbofan installation. If putting a 5ft-diameter fan (fixed pitch, ungeared airscrew) in front of a turbojet does not turn the jet into "*simply* a glorified turboprop," what does? I refer Mr Stroud to Roger Bacon for enlightenment along the lines suggested (*Straight and Level* for October 9, 1959).

I would remind Mr Stroud that I speak from great experience, e.g., two years in the RASC, one flip round Elmdon, one return trip from Penzance to the Isles of Scilly (I feel the take-off from St Mary's qualifies me to comment on rugged take-offs) and five years' avid *Flight* readership. My wife thinks I would be better employed painting the bathroom than trying to put the aviation world to rights. Mr Stroud probably agrees. I wish him a happier New Year than his comment gave to me.

Birmingham 22a G. L. WILLIAMS

S.E.5 Armament

RECENT letters and photographs in your Correspondence columns on the subject of various examples of S.E.5 prompted me to write of one or two points which have puzzled me for some time regarding this aircraft.

During a discussion on aircraft of the First World War the question was raised whether a pilot could reach his fuselage-mounted guns. We had been considering means of firing the guns and the point was raised that one or two pilots in their memoirs had mentioned clearing the breech when a gun jammed. At a later date I had the opportunity of talking to an ex-pilot who claimed to have flown S.E.5s and I asked him if it was possible to clear the breech on the Vickers. His reply was: "Oh yes, we just had to reach out over the edge of the cockpit." I questioned this on the score that the Vickers in the S.E.5 had its breech covered and would only have been accessible from *inside* the cockpit. To this my informant replied that the S.E.5s he had flown all had twin Vickers mounted externally on top of the fuselage. This assertion, coupled with a later statement that he had also flown Camels off a platform mounted on the gun turret of a cruiser, made me doubt the accuracy of his memory. I have failed to trace a RNAS squadron which flew S.E.5s.

A few weeks later I was sitting reading a book whilst my wife watched on the TV an old Fred Astaire film, the title of which—*The Irene and Vernon Castle Story*—did not inspire me to watch. Then I heard the magic words "Royal Flying Corps" and there was Mr. Astaire (alias Castle) doing a song and dance in front of a very real looking S.E.5 as part of a recruiting drive for the RFC. I immediately became interested and soon I was treated to some excellent film of what I am sure were genuine S.E.5s, all of which sported twin externally mounted Vickers guns.

The aircraft used in the film were most probably American-built S.E.5s, but nowhere can I find any reference to anyone ever having fitted twin Vickers to an S.E.5.

Perhaps one of your more informed correspondents can settle the question of whether my ex-RNAS S.E.5 pilot was correct; or had he seen the film before I did?

Stevenage, Herts J. ANDREWS

[To our knowledge there is no record of any British S.E.5s having twin Vickers guns.—Ed.]

Mystery Picture

THE photographic puzzle offered by H. G. Cloete-Noding (Correspondence, December 25) calls to mind an early war-time photograph on page 23 of *Bomber Command* (HMSO, 1941). This is of a German patrol-ship from the air, in which a very strong shadow of pilot and flight-deck canopy appears to extend over a large area of sea.

The solution is intriguing and best left to an expert; I would only suggest that a shadow thrown on concave Perspex might possibly be compressed within the limits of the lens angle.

Perhaps a photographic expert could also help to solve another puzzle, namely the photographs in *Death in the Air* published by Heinemann in 1933. Claiming to be the diary of a RFC pilot, the text does not entirely ring true, nor do many of the photographs. On the other hand, I would like to learn how other photographs could possibly be faked and also I was extremely surprised to find some reproduced in the German edition of *Der rote kampfflieger*, by von Richthofen (Ullstein, 1933). One does not expect fakes in a book of this nature.

I realize that *Death in the Air* has been the subject of considerable controversy in the past; have any new facts been brought to light?

Windsor, Berks C. JOHN BARRON

CORRESPONDENCE IN BRIEF

An Australian reader, Peter Hanna, wants to obtain a Coronation Number of *Flight* (May 29, 1953) and asks if any other reader who has one for sale will get in touch with him at 13 Mina Rosa Street, Enfield, Sydney, NSW.

Sqn Ldr L. F. Henstock is collecting data for a book on the flying characteristics and general operation of 16 aircraft of the 1914-18 period: Maurice Farman, B.E.2c, Pup, F.E.2b/d, R.E.8, D.H.2, D.H.5, Camel, Sopwith Triplane, S.E.5/5a, Bristol Fighter, Dolphin, Handley Page 0/400, Short 184 Seaplane, F-type flying-boat, S.S. airship. He writes that he would be grateful if ex-pilots, observers, fitters, riggers, armourers, wireless fitters, photographers, and others who could provide information, would get in touch with him at 25 Church Street, Ashbourne, Derbyshire.

FORTHCOMING EVENTS

Jan. 15. Denham Flying Club: First Annual Dinner.
Jan. 15. RAeS (Agricultural Aviation Group): "Biological Factors in Agricultural Aviation," by C. V. Dadd.
Jan. 15. Institute of Navigation: "Heading Definition in Commercial Aircraft," by J. Green and A. P. Glenny.
Jan. 16. British Interplanetary Society: Schools Lecture, "The Scientific Exploration of Space," by Dr N. H. Langton.
Jan. 19. RAeS: "Some Aerodynamic Problems of Engine Installation," by Dr J. Seddon.
Jan. 20. Kronfeld Club: "Some Experiences of Flying from 1914 Onwards," by R. M. Charley.
Jan. 21. RAeS (Main Lecture at Cambridge Branch): "Research at the College of Aeronautics, Cranfield," by Prof A. J. Murphy.
Jan. 23. Aircraft Recognition Society: Annual All-England Competition.
Jan. 25-28. Institute of the Aeronautical Sciences: 28th Annual Meeting and Honours Night Dinner, New York.
Jan. 27. Kronfeld Club: Film Evening.
Jan. 29. RAeS Man-powered Aircraft Group: "Engineering Aspects in Man-powered Flight," by B. S. Shenstone.
Feb. 2. British Interplanetary Society: "The Use of Reinforced Plastics in Rockets," by A. Wilson.
Feb. 2. RAeS: "Suppression of Shock-induced Separations by Boundary Layer Control," by H. H. Pearcey.

RAeS Branch Fixtures (to Jan. 21): Jan. 15, *Birmingham and Wolverhampton*, "Aircraft Heat Exchangers," by Dr W. Bergwerk; *Preston*, Annual Dinner and Dance. Jan. 18, *Derby*, a.g.m. and Film Show; *Halton*, "Aircraft Carriers," by J. C. Lawrence. Jan. 19, *Glasgow*, "Development of the Olympus Turbojet," by E. Mosedale. Jan. 20, *Bristol*, "Space Medicine," by Wg Cdr P. D. C. V. Whittingham; *Brough*, "Flying with the Trans-Antarctic Expedition," by Wg Cdr J. H. Lewis; *Coventry*, "Transport Command," by Gp Capt F. C. Griffiths; *Preston*, "Aircraft Structural Testing," by H. C. Channon; *Reading*, "Airline Routing," by A. Williams. Jan. 21, *Isle of Wight*, "Aircraft Production," by A. Vines.

Two of the Truro aircraft servicing vehicles described on this page. At left is the Solway oil dispenser with its trailer unit, and above is the hydrant-fuel dispenser as supplied to English Electric

THE INDUSTRY

Variety in Fuelling Equipment

A RECENT addition to the range of lubricating oil dispensers made by Truro Engine Works Ltd, Morden Road, London SW19, who manufacture a diverse range of refuelling equipment, is the Solway, produced for Shell International. This unit has a two-grade oil-dispensing system and can pump Aero Shell 100 at flow rates of up to 18 Imp gal/min. It is a composite tractor/trailer unit, the powered vehicle—a Land-Rover—having a 100gal tank and the trailer a capacity of 400gal. The company also make other oil equipment with capacities of 60 Imp gal upwards, tractor- or trailer-mounted.

Truro Engine Works manufacture, too, a wide range of water/methanol equipment, from an emergency hand pack unit upwards. One example is the 120 Imp gal Medway dispenser (used by Shell International), which has a pneumatic discharge. The company also have many types of aviation gasoline and kerosine dispensers available and make a wide range of hydrant dispensers, for overwing and underwing refuelling. They have recently completed a second low-pressure hydrant main dispenser, fitted with a booster pump, for English Electric Aviation; it is used for refuelling the Lightning. Truro Engine Works are able to undertake the installation of complete hydrant systems.

Hunting Survey Changes

TWO changes have been announced by the Hunting Survey Group. In Britain, the activities of Hunting Geophysics Ltd have been merged with those of Hunting Aerosurveys Ltd, and the name of the new combined company will be Hunting Surveys Ltd. The other two companies in the British division of the Hunting Survey Group, Hunting Technical Services Ltd and Aerofilms Ltd, will continue to work in close association with Hunting Surveys Ltd. The other reorganization is in Canada, where the activities of the Photographic Survey Corporation Ltd, Hunting Airborne Geophysics Ltd and Hunting Technical & Exploration Services Ltd have been combined under the name of the Hunting Survey Corporation Ltd.

T. D. Weatherhead, formerly managing director of Hunting Aerosurveys Ltd, becomes managing director of Hunting Surveys Ltd; and D. N. Kendall, vice-president of Hunting Associates Ltd (the controlling company for all Hunting's aviation and survey interests in Canada), president of Hunting Survey Corporation Ltd. C. P. M. Hunting remains president of Hunting Associates Ltd and is chairman of Hunting Surveys Ltd.

Castrol 98 Approved

A NEW aviation gas-turbine synthetic lubricant, known as Castrol 98 and produced by C. C. Wakefield & Co Ltd, has been approved by the ARB and Rolls-Royce Ltd for Rolls-Royce Dart engines. All BEA Comets and Viscounts, state the company, are to fly on it in future.

The lubricant, of 7.5cs viscosity, is based on a diester of the type widely employed in this field, with a combination of additives designed to give maximum oxidation and corrosion resistance coupled with good thermal stability, shear stability and load-carrying capacity. The lubricant is suitable for both pure-jet and turboprop engines and tests in other types of aviation gas turbines, including the Rolls-Royce Avon, are in progress.

Ultra Electric Re-organization

CHANGES in the structure of Ultra Electric (Holdings) Ltd have been announced. Two subsidiary companies are being formed, under the overall management of the holding company. Edward E. Rosen, who has been chairman and managing director throughout the firm's 40 years' existence, remains chairman of the holding company and the subsidiaries. A. V. Edwards has been appointed managing director of each of these subsidiary companies.

One of them, Ultra Radio & Television Ltd, which will handle domestic radio and television, has as its subsidiary Pilot Radio & Television Ltd (acquired by the Group early last year). The other, Ultra Electronics Ltd, will handle activities formerly carried out by the Special Products Division. In addition to Mr Rosen and Mr Edwards, other members of the board of Ultra Electronics are L. R. Crawford (general manager), Dr F. W. Stoneman (chief engineer), J. S. Williams (works manager) and E. R. Wright (commercial manager).

IN BRIEF

The Automotive Products Group announce that E. Beaumont and S. M. Parker have been appointed deputy managing directors in addition to A. C. Burdon.

High Duty Alloys Ltd have closed their Hillington office in Glasgow and opened a new one at De Quincey House, 48 West Regent Street, Glasgow C2 (telephone Douglas 1500).

The third in a series of publications on ICI wrought titanium, *Corrosion Resistance*, has been published by the Metals Division of Imperial Chemical Industries Ltd.

Brent Chemical Products Ltd, of Commerce Road, Brentford, Middx, announce that their Ardrox No 996 flaw-detection fluid, for the checking of castings and stressed components, is now available in aerosol dispensers.

Having relinquished his directorships of Pamphonic Reproducers Ltd, W. Bryan Savage Ltd and Pye Marine Ltd, V. G. P. Weake is taking up the chairmanship of the newly formed Derritron group of electronic equipment companies.

The Coventry Victor Motor Co Ltd have engaged the services, as engineering consultant, of E. Chatterton, BSC(ENG), MIMECHE, FRAES. In collaboration with the chairman, W. A. Weaver, he will be responsible for all engineering aspects of the business.

Subject to Exchange Control permission being granted, the Barden Corp, of Danbury, Conn, is to acquire "a substantial share interest" in E.M.O. Instrumentation Ltd, of Bracknell, Berks. In announcing this, the British firm states that both concerns are manufacturers of ball bearings of the highest precision and that they will now have the advantage of co-operation with the American company's design staff and will be able to call on US production facilities. The Bracknell factory is shortly to be doubled in size.

The Birmingham Tool & Gauge Co Ltd and the North West Machine Design Co Ltd have formed a joint subsidiary company, Production Machines Ltd, for the design and manufacture of special-purpose machines and equipment. G. D. Bond is chairman and E. A. Cartner managing director.

Known as Waltersolv, a new product has been added to the range of protective processes marketed by the Walterisation Co Ltd, of Purley Way, Croydon, Surrey. Intended for use as an additive to zinc phosphating solutions such as that used in the Fasbond process, it enables degreasing and phosphating to be carried out in the same medium.

The three D.H. Comet 4Cs ordered by Cia. Mexicana de Aviacon are to be equipped with Dagenite batteries Type 12 ECM13-VA, manufactured by Pritchett & Gold and E.P.S. Co Ltd. Weighing only 42lb filled, these batteries are of the same design as those specified by BEA for their Comet 4Bs and differ only slightly from the Dagenite batteries used by BOAC and Aerolineas Argentinas for their Comet 4s.

The Hadfields Group announce that at his own request T. H. Arnold, MBE, FIM, is relinquishing his appointments as local director and controller of the research department and also as a director of two subsidiary companies. Mr Arnold joined the company in 1915 and has carried out much original research into the constitution of manganese steel and the metallurgy of armour-piercing projectiles. He is succeeded by L. G. Finch, BMET, PHD; and J. A. Grainger, MENG, has been appointed deputy research controller.

A tail-to-nose study of squadron markings provided by a Javelin FAW.6 of No 85 Sqn accompanied by a Hunter F.6 of No 65 Sqn. The hexagon on the Javelin is white, the squares behind it black and red. The Hunter bears a black lion in a white circle, on red-and-white arrowhead markings

SERVICE AVIATION

Royal Air Forces and Naval Flying News

NATO Appointment

IT was announced shortly after Christmas that Vice-Admiral C. L. G. Evans, Flag Officer Aircraft Carriers, had been appointed to succeed Vice-Admiral W. J. Woods as Deputy Supreme Allied Commander Atlantic from next April. It was recently announced (*Flight*, December 11) that Vice-Admiral Evans would be succeeded as FOAC by Rear Admiral R. M. Smeeton.

Bomber Command Visit

ON Wednesday last week the Minister of Defence, Mr. Harold Watkinson, visited Bomber Command headquarters at High Wycombe. He was accompanied by the new Permanent Secretary to the Ministry of Defence, Sir Edward Playfair, and by the Deputy Chief of the Defence Staff, Air Marshal A. Earle. The visitors, who were welcomed by the AOC-in-C, Air Marshal Sir Brian Cross, were given a presentation of the role of Bomber Command.

Commonwealth Honours

TWENTY-FOUR members of the Commonwealth Air Forces have received honours and awards in the New Year list, as follows:—

HONOURS

Order of the Bath

Companion: AVM A. M. Murdoch, RAAF

Order of the British Empire

Commanders: Air Cdre D. A. J. Creal, RAAF; Air Cdre C. A. Turner, RNZAF; Gp Capt H. Hawkins, RRAF.

Officers: Gp Capt G. D. Marshall, RAAF; Gp Capt A. E. L. Davies, RAAF; Wg Cdr H. C. Salmon, RNZAF.

Members: Flt Lt R. F. Ward, RNZAF; Acting Flt Lt B. K. Drinkwater, RAAF; WO R. A. Graham, RAAF; WO E. Sheppard, RNZAF.

AWARDS

AFC: Gp Capt C. F. Read, RAAF; Sqn Ldr O. D. Staple, RNZAF; Sqn Ldr C. H. Paxton, RRAF; Sqn Ldr B. F. N. Rachinger, RAAF; Flt Lt P. Neville, RNZAF; Flt Lt B. E. Goy, RAAF.

BEM (Mil): Sgt G. C. Stevenson, RAAF; F/sgt N. J. Cooper, RNZAF; Sgt (W) A. J. Simpson, WRNZAF.

Queen's Commendation for Valuable Service in the Air: Wg Cdr J. C. Thorp, RAAF; Sqn Ldr E. A. Turner, RAAF; Flt Lt J. A. Laing, RNZAF; Flt Lt J. A. Jacobs, RAAF.

New Year Promotions

NAMES of new RAF air marshals and air vice-marshals, promoted at New Year, were given on this page last week. The following list details other half-yearly promotions, up to air commodore rank, 18 new air commodores being named:—

GD Branch

Gp Capt to Air Cdre: W. S. Gardner, D. F. Spotswood, S. W. R. Hughes, D. C. McKinley, A. R. D. MacDonell, J. B. Russell, P. E. Warcup, F. W. Thompson, W. I. C. Innes, D. M. Strong, G. R. Magill, H. J. Hickey, F. O. S. Dobell.

Wg Cdr to Gp Capt: I. R. Campbell, P. R. Casement, L. J. Joel, A. P. Dottridge, W. R. Williams, E. R. Bell, L. H. Bartlett, C. F. Bradley, A. K. Furse, R. W. Oxspring, W. J. McLean, R. D. Max, T. R. Pierce, H. H. Eccles, P. O. V. Green, A. S. Baker, A. N. Davis, D. A. Green, M. H. Le Bas, F. W. M. Jensen, J. C. T. Downey, P. W. Jamieson, B. P. T. Horsley, A. C. Blythe.

Sqn Ldr to Wg Cdr: B. S. Jones, L. C. Glover, J. L. Causton, P. H. Cleaver, P. A. S. Thompson, K. H. H. Cook, L. V. Craxton, E. M. Sparrow, I. L. Dunn, P. Barber, J. Dalgleish, J. H. Lewis, J. C. Cox, K. Lister, G. Blakeman, F. Bowen-Easley, J. I. S. Digman, D. R. Locke, J. F. Manning, P. T. Bayley, D. W. Bedford, J. H. Hedger, L. G. A. Bastard, A. C. Davies, P. M. Walker, R. J. S. Spooner, D. F. H. Grocott, V. R. L. Evans, D. W. H. Smith, G. L. Pendred, J. G. Mathews, H. Bennett, A. A. Smailes, W. L. Green, E. W. Talbot, D. L. Attlee, C. A. Sullings, A. W. Tarry, W. E. F. Gray, J. R. Ramsden, A. J. Owen, G. W. Johnson, R. H. Crompton, S. J. Hubbard, W. J. H. Roberts, R. W. Payne, P. P. Walker, A. D. Dick.

Sqn Ldr to Wg Cdr (Supplementary List): F. H. P. Lewer, W. H. Pope, D. P. J. Smith.

Flt Lt to Sqn Ldr: B. I. S. Perowne, K. L. Lewis, W. M. Drake, T. G. G. Dexter, R. D. Pilcher, J. V. Cordery, R. H. D. Dulieu, E. R. A. Shelton, R. James, D. J. Mitchell, D. Bish, E. J. Shaw, V. C. Keay, D. J. Lomas, W. C. Cox, R. H. Leviseur, M. W. R. H. Tyler, J. M. Maginn, B. R. Browne, M. J. G. Morley, D. Guthrie, T. A. G. McLachlan, M. G. Beavis, D. J. S. Foard, S. T. G. Price, A. C. Tye, G. M. Scarrott, B. P. W. Mercer, C. A. Vasey, P. J. Giddens, B. D'Oliveira, P. C. A. Major, R. M. Raw, D. C. Luck, G. O. Eades, D. H. Magor, J. A. Gilbert, F. B. Monge, C. N. C. Mitchell, I. A. Simmons, M. C. Newman, J. L. Dillon, I. G. Warren, J. W. Heard, D. M. K. Atherley, A. L. Bennett, G. H. Beaton, J. D. Barwell, R. F. Grattan, R. R. Harding, R. J. Barnden, S. W. Bainbridge, W. Topping, P. Blake, J. L. Gregg, D. Dattner.

Flt Lt to Sqn Ldr (Supplementary List): J. W. Woolfries, D. M. Howorth, E. S. Barrow, R. E. Mackie, A. J. Smitz, A. J. Mould, G. H. Allen, I. Boyd, G. W. Milburn, G. A. Murray, W. House, A. A. Robertson, L. J. Davies, L. C. Akehurst, D. J. Cutts, R. S. Hutley.

Technical Branch

Gp Capt to Air Cdre: W. D. Disbrey (seniority July 1, 1959), J. W. Bayley, E. M. T. Howell.

Wg Cdr to Gp Capt: S. Williams, J. W.

Marshal of the RAF Sir Dermot Boyle held a reception on December 30 to mark the end of his term as Chief of the Air Staff, and is here seen (left) with Lady Boyle welcoming his successor, Air Chief Marshal Sir Thomas Pike, accompanied by Lady Pike

SERVICE AVIATION . . .

Air Cdre G. C. Hartnell (left), whose appointment as AOC Butterworth was recently announced; and Wg Cdr J. W. Hubble, who is the new commanding officer of No 77 Sqn at Butterworth, the RAAF station in Malaya

McCombie, A. H. Dormer, E. T. McCabe, J. W. McKelvey, C. N. S. Pringle.

Sqn Ldr to Wg Cdr: A. V. Breese, P. D. Cherry, D. L. Hart, W. M. Smedley, G. V. R. Jones, R. E. Smith, W. J. Knowles, N. F. Ruse, W. J. Pope, W. C. Taylor, R. M. Morton, L. G. Goodey, R. J. Edmonds, J. R. Davies, D. S. Perrin, J. H. Jenkins, W. D. Hunter, E. J. T. Goose, S. L. Gordon, P. Cadman, I. T. A. Murchie, K. W. Haynes, H. A. J. Steedman, I. B. Clark, W. A. Appleton.

Flt Lt to Sqn Ldr: T. H. Jackson, T. W. Chapman, H. W. V. Taylor, J. G. Horner, R. Gowing, T. Nesbitt, C. G. H. Frank, E. W. Stanley, P. J. Colebourn, E. D. Jackson, R. W. Wright, M. C. Ferguson, P. D. Beevers, K. T. W. Mackenzie, H. A. Mills, D. McK. McWilliam, J. Jepson, F. H. Gardiner, J. M. A. Baker, G. B. Tyler, T. R. Minihane, C. Duckworth, W. K. MacTaggart, R. C. Bowers, K. E. Chambers, P. G. Hann, F. Jones.

Flt Lt to Sqn Ldr (Supplementary List): P. A. R. Keates, F. C. T. Terry, F. J. A. Blagden, E. Masterman, A. Fearnside, J. Baseley, A. E. Grover, R. H. W. Beer, H. A. Steele, C. B. Dixon, R. J. Moore, R. C. Orme, W. H. Nelmes, R. E. Elworthy, H. A. Farley, R. N. Pringle, R. E. Humphreys, A. G. F. Campodonic, A. S. Howard, F. H. Holdstock, J. P. V. Weir.

Equipment Branch

Gp Capt to Air Cdre: W. MacI. King, L. C. Dennis.

Wg Cdr to Gp Capt: H. Stones, J. C. Wickham, J. O. Gale.

Sqn Ldr to Wg Cdr: S. McN. Greig, P. R. M. Groom, L. B. Davey, J. E. Smalley, R. B. Harrison, C. Murray, G. W. Bennington, H. C. McFarlane, J. R. Stowe.

Flt Lt to Sqn Ldr: R. Willoughby, J. C. Wardill, L. G. Prest, S. Dwight, H. Kitchen, E. L. C. Higgs, J. M. B. Cannell, G. R. Perkins, C. R. Scott-Jackson, P. C. B. Ratcliffe, K. Macrae, A. S. B. Smith, J. E. Gower-Jones, C. G. J. Delaney, R. J. Riley, J. M. Stevenson, R. G. Longley, D. R. A. Hooley, C. S. Jackson, L. Davies, H. Dufton, R. D. McNair, F. Priestley, W. Steven, D. I. O'Hara.

Flt Lt to Sqn Ldr (Supplementary List): J. W. Judge, G. A. Long, K. Trojacek, F. E. Storry, R. J. Hutchinson, K. V. Ormsby.

Secretarial Branch

Wg Cdr to Gp Capt: H. A. F. Summers, R. A. Webster.

Sqn Ldr to Wg Cdr: G. W. Swanwick, E. H. Tidswell, N. S. C. Chapman, H. Edwards, B. L. Davis, J. R. Goodman, G. M. Heath-Smith, F. S. Wright, W. S. Lloyd.

Flt Lt to Sqn Ldr: F. R. Godsmark, E. Cathcart, F. S. Lacy, J. A. Abbott, J. McK. Keogh, R. V. Palmer, P. A. Bellerby, H. Duncan, L. J. Ayling, M. G. Patzelt, B. A. A. Snook, A. N. Aylin, I. R. Walkington, A. E. Bullivent, N. George, D. R. Buchanan.

Flt Lt to Sqn Ldr (Supplementary List): W. Rogalski, A. P. Verrinder, A. T. Boarder, L. C. Packer, G. M. Ellis-Jones.

Flt Off to Sqn Off (WRAF Supplementary List): J. Gray.

RAF Regiment

Wg Cdr to Gp Capt: H. Sullivan.

Sqn Ldr to Wg Cdr: J. F. Oliver.

Flt Lt to Sqn Ldr: F. L. Thomsit, M. J. Ashe, P. Lovatt, R. J. Page.

Medical Branch

Wg Cdr to Gp Capt: M. O. Richardson, H. W. Whittingham, F. S. Krusin.

Dental Branch

Wg Cdr to Gp Capt: G. W. Hargreaves.

Education Branch

Sqn Ldr to Wg Cdr: E. B. Haslam.

Provost Branch

Flt Lt to Sqn Ldr: C. F. G. Parsons, G. Innes.

Fg Off to Flt Lt (Supplementary List): F. P. McKenna, E. A. C. Yell.

Catering Branch

Wg Cdr to Gp Capt: N. H. Bennett.

Sqn Ldr to Wg Cdr: L. J. Morris.

Sqn Off to Wg Off (WRAF): S. Harding.

Flt Lt to Sqn Ldr: P. S. Thompson, R. G. Preece, R. J. Templeton, G. L. E. Sturt.

Flt Lt to Sqn Ldr (Supplementary List): R. C. Wilson.

Physical Fitness Branch

Sqn Ldr to Wg Cdr: G. F. Turnbull.

Flt Lt to Sqn Ldr: R. McDonald, E. W. Taylor.

Flt Lt to Sqn Ldr (Supplementary List): H. E. Robinson.

IN BRIEF

Wg Cdr G. P. Elliott has been awarded the DFC "in recognition of gallantry and devotion to duty in air operations in Aden and Oman."

* * *

Part of the disused RAF station at Ashbourne, Derbyshire, is to be offered for sale by the Air Ministry.

* * *

This year's RAF anniversary concert, to be given by the Hallé Orchestra and the Central Band of the Royal Air Force, will be at the Royal Festival Hall, London, on April 6.

* * *

Flt Lt W. Campbell has been appointed first CO of No 2 (City of Edinburgh) Maritime Headquarters Unit, one of the three new RAuxAF units under Coastal Command control.

* * *

Royal Air Force fixtures at Twickenham in the inter-Services rugby union competition are on February 20 (against the Royal Navy) and March 26 (against the Army). Kick-off in both matches is at 3 p.m.

* * *

This year's No 2 Sqn reunion dinner is being held at the Victory Ex-Services Club, 63-79 Seymour Street, London W2, on March 18 at 7 for 7.30 p.m. Remittances (21s 6d) should be sent by March 11 at latest to Flt Lt D. C. Gathercole, RAF Chivenor, Barnstaple, Devon, who can supply further details. Cheques and POs should be crossed and made payable to "C. S. MacDonald, No 2 (AC) Squadron Annual Dinner Account."

* * *

The reunion dinner for past and present officers of No 54 (F) Sqn, originally scheduled for January 16, has now been postponed until April 9. Further particulars may be obtained from the Adjutant, No 54 (F) Sqn, RAF Stradishall, Newmarket, Suffolk.

* * *

A former SAC who finished his National Service last year, G. P. Hercod, has been awarded a Queen's Commendation for Brave Conduct as a member of the RAF mountain rescue team from Cyprus who scaled Mt Suphan in Turkey to investigate the wreck of the Air Charter Super Trader and destroy secret equipment.

* * *

In a report on the Royal Canadian Navy in 1959 it is stated: "In the air, there was no increase in numbers, but conspicuous progress was made in developing the anti-submarine proficiency of both fixed-wing and rotary aircraft, and in sharpening the intercept capability of the Navy's guided missile armed Banshee jet fighters." The RCN operates one aircraft carrier, *Bonaventure*.

New Rear Admirals

AMONG recent RN promotions to rear admiral are those of Capt (Acting Rear Admiral) A. B. Cole, who before becoming Assistant Chief of Naval Staff in November last year commanded *Albion* for 17 months; Capt F. H. E. Hopkins, who in 1950 was Commander (Air) in HMS *Theseus* and flew in operations off Korea, then later (in 1956) commanded *Ark Royal*; and Capt F. R. Twiss, who in 1955-1956 commanded RNAS Bramcote.

Director of Plans

APPOINTED Director of Air Plans at the Air Ministry, Air Cdre R. J. P. Prichard recently completed the 1959 Imperial Defence College course. He had previously (until August 1958) commanded RAF Tengah at Singapore, and was promoted air commodore in July last year. He was awarded the AFC in 1941 and the DFC in 1943. In 1945 he was made an OBE and also an officer of the Legion of Merit (USA). Last year he was appointed CBE.

Information Wanted

TWO short histories, of RAF Ternhill and No 6 FTS, are being prepared by Sqn Ldr W. H. Cadamy; and he would be glad to hear from anyone who can contribute relevant material. His address is:—No 6 Flying Training School, Royal Air Force, Ternhill, Market Drayton, Salop.

New Helicopter Squadron

A NEW RAF helicopter squadron, No 225, has been formed in Transport Command. Equipped with Whirlwinds and Sycamores (which formerly belonged to the now disbanded Joint Experimental Helicopter Unit), it is commanded by Sqn Ldr A. Twigg.

This squadron has had two previous existences. It was formed towards the end of the First World War, then disbanded in Italy in 1919. It was re-formed at the start of the Second World War as an Army co-operation unit, and from 1941 operated Hurricanes, then Mustangs, then Hurricanes again and subsequently Spitfires. It took part in the North African and Italian campaigns and in the invasion of Southern France. Its second disbandment also took place in Italy, at Campoformido in January 1947.

Low-down on Low-level

A JOINT RAF/Ministry of Aviation unit formed to investigate the effects of high-speed low-level flight on aircraft structures and aircrew is now operating at RAF El Adem near Tobruk. The trials being carried out, known as "Swifter," are under the control of the C-in-C Middle East Air Force and crews engaged in them have been drawn from MEAF squadrons. The scientific and physiological sides are being handled by representatives of the Institute of Aviation Medicine, the RAE Structures Department and the Meteorological Office. Six modified Canberras are being used. These contain special equipment including counting accelerometers, fatigue meters observed by automatic photography units, the latest types of ejector seats and a cold air supply for the newest kind of ventilated flying suit.

Flights are being made at heights of between 100 and 600ft, with regular day and night sorties of approximately 2hr duration over both land and water. During the 12 months the trials are to last, a total of at least 1,000hr is to be flown. "Swifter" will provide factual data on turbulence below 1,000ft and information on problems of training, operation and maintenance posed by persistent low-level operations.

For the Prime Minister's journey to Africa last week BOAC made available the specially modified Britannia 102 "Bravo Bravo." Part of the super-VIP interior is seen in this photograph

AIR COMMERCE

SILVER CITY'S RAILWAY ASSOCIATIONS

LAST week—in what might be construed as the first major surrender of rail to air competition—it was revealed that the British Transport Commission had for some while been negotiating with Silver City for the purchase of a minority share in the independent airline. The capital of Silver City is at present jointly held by the Peninsula and Oriental Steam Navigation group (70 per cent), Eagle Star Insurance (20 per cent) and 10 per cent by Cable and Wireless. The last-named is a Government-owned concern; a fact not lost on those seeking a precedent for the participation in an independent airline by a company with public accountability.

Nevertheless, participation on this scale by the public commission responsible for the operation of the British railway system *is* unprecedented, but appears welcome both to Silver City and to the BTC for the possibilities it offers in expansion of rail-air services; not only to the Continent but possibly elsewhere in and from the United Kingdom.

The immediate effect of such an association must be to diminish the competition which airline and railway ferry operator present to each other on the short Channel routes to the Continent. While the vastly greater proportion of cross-Channel traffic is still carried by sea, the latter's share is in decline. In terms of accompanied cars carried (see "Channel Air Ferries," *Flight*, March 21, 1959) the sea share of the total cross-Channel ferry traffic fell from 84 per cent in 1956 to 80.5 per cent in 1958. Last year was another of ebullient growth for the air ferries—Silver City carried 76,000 cars and 200,000 passengers—and it is fair to assume that although the total level of cross-Channel traffic increased markedly over the recessional year of 1958, the trend continued for the share of railway ferry business to decline.

Under its terms of constitution the British Transport Commission are now precluded from the direct operation of air services, but they are empowered, nevertheless, to collaborate with airlines if they want to do so. Already under discussion in this context is the rail spur to Manston (and on the French side, to Le Touquet) to assist the operation of Silver City's rail-air-rail Silver Arrow Service to Paris, which has been in operation in conjunction with BR since June.

From a collaboration of rail and air transport might also come pressure from Silver City for a substantially greater part in the operation of internal air services. Silver City's employed capital is of the order of £3 million; injection of new funds might be used to increase the airline's bargaining power in the processes of merger urged by Mr Duncan Sandys, Minister of Aviation.

In the long term the airline's competitive position *vis à vis* other independent operators could thus be immensely strengthened by its railway associations.

AIR UNION'S INAUGURAL POSTPONED

THE work of Air Union's various study committees has had as its aim the inauguration of unified operations by April 1; but owing to unforeseen complexities in many legal and financial problems it seems inevitable that the executive committee will have to postpone the Union's inauguration until November 1—a change of plan that was decided by the committee last month. Such a postponement, it is said, will permit a closer study of Air Union's problems and should ease the inevitable teething troubles likely to arise in the first few months of combined operations. Whatever the final decision, operational unification of the four companies during the summer of 1960 will be preceded by bilateral and multilateral agreements to widen the scope of each partner's activities during the period immediately preceding the start of joint operations.

In the meantime, Government legal experts from the four Air Union countries of Belgium, France, Germany and Italy have had a series of meetings with representatives of the four member-airlines to decide how best to draw up a pact of association in conformity with the national legal codes of the partners; it seems that the basis of solution is to be a treaty concluded by the four governments. Agreement on an advanced draft of this document has already been reached.

As has been previously described, the foundation work of Air Union is being conducted by a number of special committees. Brief reports on their respective recent activities are as follows:

The Executive Bureau has confirmed proposals of the Programme Bureau on the unification of Air Union services to the west coast of the United States. Los Angeles and San Francisco, it has been decided, will be served by Air France and Lufthansa. This bureau has also approved the design of the Air Union insignia and the aircraft livery.

The Commercial Committee has continued preparation of a joint timetable as well as a joint "fares and regulations manual."

The Commercial Organization Group is engaged in a progressive re-organization of the partners' out-stations. As a general rule companies wishing to start new stations will use the already established offices of other member companies or will move into joint premises. For example, Lufthansa have recently moved into the Lisbon offices of Sabena.

The International Relations Committee met for the first time in November. Its task is to draw up a full list of each company's traffic rights and to formulate a common policy for employing existing rights and retaining new ones to the advantage of Air Union.

The Helicopter Working Party has been asked to produce a detailed survey of all new rotating-wing aircraft projected between now and 1965. The first meeting was held in Brussels in November.

"OUR OBLIGATIONS TO AIR UNION"

DISCUSSIONS between Air France and El Al on an exchange of passenger traffic on the routes between New York, Paris and Tel Aviv have ended in discord. Israeli newspapers have attacked France, claiming that the negotiations reached an untimely end because of the French need to improve relations with Arab governments. Subsequently Air France issued a statement denying that the breakdown had political roots and stating that only commercial matters were involved. "It appeared during the negotiations," said the airline, "that they interfered with the eventual new obligations of Air France towards its partners in the Air Union commercial co-operative body now being constituted between Lufthansa, Sabena and Alitalia. At the present stage of the negotiations being conducted for the birth of Air Union it did not appear possible to take on new commitments towards an exterior company."

The objective of many months' negotiations has been apparently to evolve a Franco-Israeli agreement whereby El Al could increase its weekly Britannia service between Tel Aviv and Paris in return for the carriage across the Atlantic by Air France 707s of passengers to and from destinations in Israel. This is the first time that the influence of Air Union in traffic horse-trading has been publicly evident.

LEEDS/BRADFORD AIRPORT

GRADUALLY, the future layout of the terminal building, apron and airline maintenance facilities at Yeadon is taking shape. There is a great deal of derelict and unwanted building, dating from earlier Ministry of Aircraft Production and Royal Air Force tenancies, which will have to be removed before any practical commercial aircraft-handling system can be achieved.

Under present conditions, not more than four aircraft of DC-3 size can be satisfactorily handled simultaneously from the parking apron in front of the main hangar. Two of the five bays of this large hangar, built by MAP during the war to accommodate Lancasters and Yorks awaiting flight-testing, are to be demolished. The remaining bays will more than fulfil future airline maintenance accommodation. Behind this hangar is a large paved area which will be further enlarged by demolition of two condemned hangars. When this paved open space is available as a terminal area, there should be room for stands for a dozen or more aeroplanes of DC-3 or Avro 748 size. The new terminal building will be built at the airport approach-road end of the "new" apron and, presumably, the present temporary terminal-building will be demolished. There is now tangible evidence of Yeadon's renaissance, for installation of threshold and runway lighting is well under way. This should be complete by the time the summer schedules start in April.

Depicted here is the first of Middle East Airlines' Viscount fleet to be equipped with Ekco E160 weather radar. The work was carried out at the airline's base at Beirut

AIR COMMERCE . . .

COMET GO HOME

THE first training flight into Warsaw by a BEA Comet 4B was made on January 6, previous training and proving flights having been refused by the Polish Civil Air Authorities. Accompanying the flight—which included a Comet demonstration at Okecie Airport—was Anthony Milward, chief executive of BEA, who travelled to Warsaw for discussions with Jan Krzywicki of LOT and Jan Rustecki, a vice-minister of transport, about opening the prospective Comet service to Warsaw in April. Later Mr Milward said that this was "now very unlikely" but that BEA "would have another shot." He went on to explain that it was for "commercial reasons" that the Comet had been refused. "I think the Poles would agree to our using Warsaw as a transit stage for Comets on the London - Warsaw service, but this is unacceptable to us. It now becomes a matter for our two governments, probably to be raised when a new joint agreement is negotiated."

On behalf of LOT it was said that while operating Convairs on its western routes and Il-14s in eastern Europe the airline could not afford jet competition until it had more modern aircraft; there had been Polish hopes of buying Viscounts, but these had received a severe setback last month when the British quota for exported Polish bacon was unexpectedly reduced. This had robbed Poland of the possibility of increasing sterling earnings and given rise to second thoughts about purchases from Great Britain requiring capital investment.

A LOT spokesman said that he thought there would be no objection to the operation of BEA Comets into Okecie if the airline were in a position to buy British airliners; in fact their only alternative was the Tu-104 which, he said, was less well adapted to Polish needs and expensive to operate.

ELECTRA ACCIDENT REPORT

THE CAB report on the accident to the Electra of American Airlines which crashed in the East River on February 3 last year while approaching to land at La Guardia Airport attributes the probable cause to crew error. A contributory factor was the crew's limited experience with the type, which had been in service with the airline only 12 days.

Preoccupation of the crew with "particular aspects of the aircraft and its environment to the neglect of essential flight instrument references for attitude and height above the approach surface" resulted in a premature descent below landing minima. The report adds that the accident could have been averted "had the first officer followed prescribed operating procedures and been fully alert . . . to all his cockpit duties."

WHERE STEAM AEROPLANES GO

IN the throes of re-equipment planning are the two Middle East air freighting independents, Trans Mediterranean Airways and Trans Arabia Airways. The former, founded in 1953 by Abu Hidar, is virtually an all-freight line and until the autumn of 1959 had practically no competition in the area. However, in September the Kuwaiti Trans Arabia Airways began operating scheduled services out of Beirut to Kuwait with a single DC-4. Their mixed passenger/freight service immediately caught on and within a few weeks a second DC-4, on charter from Starways, was pressed into use. Operating licences into various points in the Persian Gulf and neighbouring Arab states have been granted and will come into force when the company's re-equipment plans are settled.

Trans Mediterranean began the replacement of its Yorks by the purchase of two DC-4s. Since then they have been operating throughout the company's network in the Middle East and Europe though their Yorks are still to be seen at London on all-freight service. They shortly expect to add a DC-6 to their fleet.

Operating from Beirut with British crews is this British-registered DC-4 of Trans Arabian Airways, here being refuelled at Kuwait. News of the airline's activities is contained in the news-item immediately above

BEYOND LIMITS

FEDERAL AVIATION AGENCY concern about pilots exceeding jet design-speed limits is expressed in a recent statement to its regional administrators. Checks on data gathered from the flight recorders mandatory in US jets has given rise to concern that safe speeds are being exceeded "in a large percentage of flights with a frequency which is alarming because of the hazardous implications involved in exceeding design loads."

Two particular limits are involved: the V_{NO} (maximum normal operating speed) and V_{NE} (the ultimate never-exceed speed). In jets operating at high Mach numbers, V_{NO} and V_{NE} speeds are often close enough together for some concentration to be required from the pilot to see that they are not exceeded, particularly in the danger cases mentioned by the FAA of descending with power on and in gusty conditions. Ward Asden, chief of the FAA operations division, who issued the statement, suggested that one reason for the high incidence of flights beyond placard speeds was because pilots flying turboprops and pure jets may have been lulled to a sense of false security by the ruggedness and dependability of older aircraft. FAA inspectors will be undertaking checks on speed control practices on the routes but, the Agency says, the answer to this problem really lies in improving pilot training.

USED AIRCRAFT ON THE BALTIC

WIDELY used for arranging aircraft charters, the facilities of the Baltic Exchange in the city of London have been extended since January 1 to include the sale and purchase of commercial aircraft. As business through the Exchange is built up, complete information will become available to buyers and sellers of aircraft on the sale and purchase market, both on the increasing number of ex-first-line types now being offered for sale and on executive aircraft. W. S. Shackleton have recently declared their intention of appointing a representative to the Exchange.

At present something like 80 per cent of the transport aircraft sold are sold by one airline direct to another. More recently aircraft brokers in America have been taking over from the airlines the complex business of re-sale and lease of used aircraft; negotiations through the Baltic Exchange for the sale as well as the chartering of aircraft should bring business to Great Britain.

NEW YORK'S NEW AIRPORT

THERE has been much controversy about the site for a new airport for New York since the first proposals were made known. No official information has yet been issued but two likely sites are under consideration: one in Morris County, New Jersey, and another in Burlington County, about 65 miles south of Manhattan. The latter community is said to be very much in favour of becoming the home for the new airport but the Port of New York Authority is said to favour strongly the Morris County site, whose community is equally strongly opposed to an airport's construction.

No official Port of New York Authority statement has yet been issued and the position is to be reviewed at a meeting between Elwood R. Queseda, NYA director, and the New Jersey Congressional Delegation.

At Dorland House, Lower Regent Street, London, BEA are holding an exhibition of the work of their catering department, which prepares meals for more than three million passengers a year. It was opened on January 4 for two weeks and closes tomorrow

SOUND PRESSURES

THE jet-noise problem in America becomes more acute as each day goes by and more jet frequencies are offered by the airlines. In this country, around London Airport, the problem is not as urgent as it will be next summer, when something like 500 jet movements per week are expected. Nevertheless, the airlines are already putting pressure on the Ministry of Aviation to lift the present "prior-permission only" rule about jet take offs between 11 p.m. and 7 a.m. A Ministry spokesman has said that "the restrictions remain in force, but certain respresentations which have been made to us are now under consideration."

It is inevitable, as was suggested in these columns on December 18, that "sooner or later jet operators, including BOAC and BEA, must schedule jets at night . . ." As the *Daily Express* has pointed out, some relaxation is inevitable if London Airport is to remain competitive. Tackled on this score on his arrival at London Airport last week from a three-day visit to Germany, Duncan Sandys, Minister of Aviation, declined to comment.

Meanwhile, pressure is being brought to bear on the American Federal Aviation Agency to lay down the law about jet noise. At Los Angeles the FAA have proposed a plan requiring night take-offs to be from runways that will carry the jets out and away over the Pacific. This is the airport at which the ILS glide-path has recently been cocked up from 2½° to 3° at the instigation of the Los Angeles airport authorities. The American domestic airlines, through ATA, urge recognition of the pilots' need to "undercut" the glide-path in order to flare out for touchdown so as to avoid the risk of overshooting.

Footnote on scheduling: By mutual agreement PanAm, TWA and Air France—all Boeing 707 Intercontinental operators—have agreed to a truce over the times advertised in current timetables for their trans-atlantic flights. For the winter period all three will schedule: London - New York, 7hr 40min; New York - London, 6hr 25min; Paris - New York, 8hr; New York - Paris, 6hr 45min.

Demise of an Enterprise

BRIEF notes in United Kingdom newspapers last week referred to a merger between two airline companies in Southern Rhodesia—Hunting-Clan African Airways and Air Carriers. It was reported that the merger would "provide a combination to meet present and future demands in the Federation for the type of charter work carried on by Air Carriers, and for the development of tourist facilities pioneered by Hunting-Clan and by Victoria Falls Airways—a subsidiary of Air Carriers." The arrangement provided for the acquisition of a substantial interest in Air Carriers by Hunting-Clan, and the main operating company was to be known as Hunting-Clan Air Carriers.

As might be expected, there is more to this merger than the bare announcement suggests. A *Flight* staff member recently in the Federation is able to fill in some of this background. In effect, the merger marks the end of a bid by the British independent to expand its interests by the formation, in May 1955, of an African associate. These interests have always had to be measured against those of the Government airline, CAA. The test came in 1957, when the parent British independent made a bid for the acquisition of CAA—a bid which, as history has recorded, came close to success, finally having to give way to BOAC's counter bid.

Since that date the fortunes of HCA's African associate have declined until, on December 31 last, the company ceased operations with its own aircraft. Nevertheless, Hunting-Clan African Airways make no apology for the part they have played in operating and developing air services within the Federation, and cargo services to East Africa and South Africa. (In addition, inclusive tours to Mozambique from South Africa and from the Federation have also been operated; these may be continued by the new company.)

From the start HCAA recognized that the going would be difficult, that initial losses could be expected, and that there was no question of getting rich quick. But there was a conviction that the Federation needed more air transport for its development, and that this would be welcome to the Federation Government as a private-enterprise contribution. Now, after four-and-a-half years, HCAA has decided to retire from scheduled activities, merging its interests with Air Carriers in order to concentrate on charter work.

HCAA did feel that it could have continued its unsubsidized contribution to the Federation's economy had it been granted licences to operate routes with the capacity to offset its poorer routes. Indeed, the airline considered that restrictive regulations prevented it from developing its operations in an economically balanced way. Events, HCAA said, were quite contrary to the Minister of Transport's policy, made known in 1956, that the Federation welcomed the introduction of private enterprise and that there would be room for HCAA to operate alongside CAA. For example, HCAA cited:—

(1) Lack of freedom to offer cargo capacity at rates which the market would stand.

(2) Prevention of the operation of any significant regional routes (e.g., services between the main towns of the Federation, or between Salisbury and Johannesburg and Salisbury and Nairobi), despite the undertaking that such operations would be at lower fares sufficient to ensure new markets and the minimum diversion from CAA.

(3) Restrictions on such licences as were granted so as to prevent reasonable development of the routes concerned.

(4) Restrictions on charter activities between the Federation and the Union, resulting in greater freedom for South African operators than for HCAA.

The airline felt that the basis of all the arguments raised against their expansion was always "less for some" rather than "more for all."

Flight was able to ask the Federation Minister of Transport, W. H. Eastwood, for his views on the demise of HCAA. Asked whether he considered that HCAA had made a contribution to the Federation's air transport economy, Mr Eastwood said that the fact that they had lost money spoke for itself. He added, however: "I say that we have gone out of our way—we have even come close to abrogating the Act—to assist Hunting-Clan African Airways to develop." He explained that the Act enjoined the Air Authority to avoid allowing private-enterprise air transport to overlap CAA's operations. HCAA, he said, originally entered the Federation on the basis of operating freight feeder services. In due course they applied for licences to carry passengers, and this was agreed to. They had been given a franchise to develop services to serve the Kariba project.

We asked Mr Eastwood whether HCAA's withdrawal from scheduled services would mean an increase in the subsidy paid (about £160,000 last year) to CAA. "We can't say yet," he replied. "We are hopeful it will not, especially now that the recession is coming to an end."

HCAA, naturally enough, have ready answers to all these points. But they feel that they have made their case clear enough during the past four-and-a-half years, and that the time has now come to withdraw. It is certainly true that, in any case, arguments between private enterprise air transport operators and governments which feel that their chosen instruments must be protected are invariably pointless. It remains to be seen whether the departure of HCAA from the Federation's scheduled operational scene results in a higher level of subsidy of the chosen instrument. But whatever the political pros and cons of private-enterprise participation in air transport, it is a matter for regret that this particular enterprise should have decided to cut its losses—with all that this means in the personal hardship suffered by loyal and efficient personnel.

The company's two DC-3s have now been sold, and all but one or two of the company's eight pilots have found jobs with HCA's Middle East interests (operations on behalf of the Iraq Petroleum Company), with CAA, or with the RRAF. Some 40 other staff became redundant on December 31. Henceforth Union Castle will act as general sales agents for the parent company's Africargo and Safari services, and CAA will handle the traffic aspects of the Safari services. The Kingsway Air Station in Salisbury will be retained as a town cargo centre.

BEING SENSIBLE

WHEN Canadian Pacific Airlines placed their order for four Conway DC-8 Intercontinentals (*Flight*, November 6, 1959), there were rumours that some sort of maintenance and spares holding arrangement with TCA—who already had six Conway DC-8s on order—was envisaged. This is now confirmed: the Canadian Government has approved the agreement between the State airline and its private-enterprise competitor for a joint DC-8 servicing arrangement. Precise details of the agreement are not yet available, but it is understood that CPAL's Conways will be overhauled by TCA at Montreal.

Commercial rivalry between TCA and CPAL (who, of course, now parallel each other on the transcontinental domestic route) will no doubt continue as keenly as ever. The fact that such a sensible agreement was reached by these keen rivals is indeed remarkable. The result can only be a reduction in the overall cost of air transport in Canada, yet with no diminution of the benefits of commercial competition. The two airlines are idealogically further apart than the Old Country's two State airlines; yet BOAC and BEA, though operating common equipment like the Comet, continue to have no technical or operational common service of any kind.

CHEAPER TO PARIS

SKYWAYS have announced that their tourist fares for the Coach-Air service to Paris, as they apply from April 1, are to be reduced; the minimum fare will be less than any the airline has ever previously offered. The lowest of a variety of different fares for day, night, mid-week and weekend travel is now £5 10s return for the "inclusive" night excursion valid for 90 days, although to this must be added another "inclusive" return fare of 35s for the coach part of the journey from London to Lympne and Beauvais to Paris. In their information circular about these fares Skyways say that all fares are "truly inclusive and do not attract air taxes, coach fares, tips or other incidentals": an odd contradiction, because the £5 10s return fare is clearly *not* inclusive of the coach journeys. These reduced fares are still subject to Government approval.

Better service is also being offered in terms of frequency and travelling time. Skyways hope to cut down the overall journey time from the centre of London to the centre of Paris to 5½hr and at the seasonal peak the frequency will be stepped up from 12 to 18 return services a day. Skyways' London to Paris service operates daily throughout the year and is supplemented by seasonal services to Lyons, Vichy, Montpellier, Dijon and Tours.

PROGRESS IN REFUELLING

WHEN the Severn refueller—the first of five ordered for Shell-Mex & BP—went into service at London Airport just before Christmas the event was a landmark in the company's history there: shortly before the end of the year they reached a total of half-a-million aircraft fuelled and oiled at the airport.

The Shell and BP aviation services were established in mid-1948 after the dissolution of the Petroleum Board, which had controlled all petroleum distribution during the war. In 1949, the first full year of independent operation, 12,500 aircraft were fuelled or oiled; by 1959 the annual total was over 85,000.

Shell-Mex & BP started operations at Heathrow Airfield (as LAP was then known) in 1946 with a staff of ten led by the present manager, James Grant. The office was in the police hut and the fuellers were five ex-RAF vehicles. Today the company has over 160 employees at the airport, providing a round-the-clock delivery service from 30 radio-controlled fuellers. To these vehicles is now added the Severn referred to above; 50ft in length, it weighs 54 tons with its maximum load of 10,000 Imp gal of turbine fuel on board, and it can supply at 750gal/min.

UP TO DATE WITH EAA

THE national airline of British East Africa considers that it has a right to 50 per cent of the traffic moving between the territories and the UK, because most of this traffic originates in East Africa. This is the view of Col M. C. P. Mostert, general manager of EAA, as recorded in *Flight* for January 1. A staff member recently in Nairobi talked with EAA, and formed a number of impressions about the trend in this airline's progress.

First and foremost, EAA is committed to a long-haul destiny. Unlike its Commonwealth neighbour CAA, it is not content to draw in its long-haul horns, selling its services to the UK to BOAC in order to concentrate on internal and regional services. This point is proved by the order for two Comet 4s.

It is no secret that this order came very close to cancellation about a year ago. The reasons were not forthcoming, but it is reasonable to assume that both technical and financial considerations were giving rise to anxiety. Col Mostert once had the vision of EAA, BOAC and SAA all operating Comet 4s on the UK - African route, sharing spares and servicing facilities to the benefit of each airline. This vision was clouded when SAA decided to buy Boeing 707s—a decision made in February 1958. But the Comet order, he told us, is firm. It remains to be seen whether SAA ever have occasion—if ever their 707 load factors perhaps dip into the 40s—to rue their choice. It would be ironic, in our view, if Comet 4s had to subsidize empty seats in the 707s with which they will be operating in pool.

Col Mostert would not discuss the financing of his Comet 4s. But he said that there was no doubt whatsoever about the firmness of the order: delivery would be made between June and July. The contract was signed, and de Havilland were paid up to date. Would EAA purchase more than two Comets? Progress to date, he considered, did not justify any more Comets. "We shall not be able to decide," he said, "until things settle down." It was BOAC's and EAA's intention that the Comet should completely supersede the Britannia in the pool arrangement between the two airlines. EAA would undertake their own Comet 4 maintenance, with the exception of the Avon RA.29, and would be quite independent of BOAC from the maintenance point of view. Comets were being depreciated, like those of BOAC, over seven years with 25 per cent residual value.

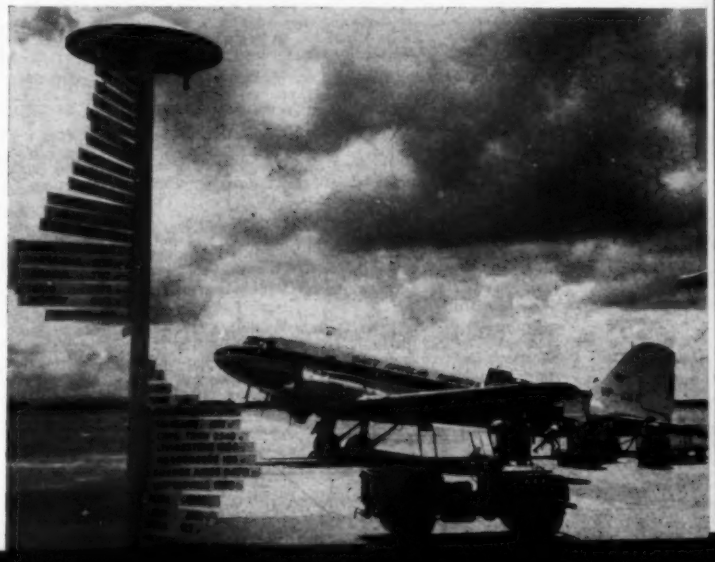
From the Transport Ministry in Nairobi we learned that EAA were raising a loan in London for the purchase of their Comets, but no more details than this could be supplied. It was explained that the question of financing is always a private matter.

After seeing EAA's shining DC-3s (one of which was literally stripped to its bare shell, wings off, for its 18-month 3,000hr check) we asked Col Mostert about his DC-3 replacement policy. He explained that in the spring of 1959 he had decided to keep his DC-3s for about four years from that date. Already the aircraft were almost off the books. When asked which twin-Dart replacement he preferred, and whether he rated technical considerations above the reputation of the manufacturer, he said: "We like to buy an aircraft from a good stable. My personal feeling when I heard about the Avro 748 was that I knew they would give us support if something went wrong." But he would not anticipate which aircraft, if any, EAA would choose.

EAA, he said, visualized a two-type fleet—"This is our aim and object. The fleet would be Comet 4s and an aircraft for internal and regional services of bigger capacity than the DC-3. The DC-4Ms had been bought mainly for EAA's internal services. He could not say how much BOAC had been paid for these aircraft—this had been a "complicated arrangement."

Col Mostert gave us a conducted tour of his base, which is impressively clean, well ordered and well equipped. The fleet comprises nine DC-3s, three DC-4Ms and four Dominies (which will be retired next June). The Canadairs' Merlins, which are shipped to the UK for overhaul, now have a life of 1,000hr.

So far as 1959 financial results were concerned Col Mostert said, "I think we shall show a small profit—we will do just better than break even." Asked whether he would attend the proposed meeting of Commonwealth airlines in London next spring reportedly intended to co-ordinate Commonwealth air transport policy, Col Mostert said, "We hope we shall be invited. If not, we shall certainly arrange for ourselves to be invited!"



Poised in this recent "Flight" photograph behind Nairobi Airport's famous signboard is one of the immaculate DC-3s used by East African Airways. The airline's views on replacement are discussed above

AIR COMMERCE . . .

ACCIDENTS: 1960's UNLUCKY START

WHEN analyses of UK accident statistics for 1959 are completed it seems likely that the last year of the fifties may prove to have been a record safety year.

By contrast, the world safety record in 1960 got off to a disheartening start. With the new year only three days old a fatal accident occurred when an Indian Airlines DC-3 flying out from Jorhat on a food-dropping mission near the Indo-Tibetan border crashed about six miles west of Taksing. It is believed that there were no survivors among the crew of eight on board.

No fewer than three accidents, of varying severity, occurred on January 6. This was the day on which tragedy befell a National Airlines DC-6B on a night-coach flight from New York to Miami. It crashed near Bolivia in South Carolina with the loss of all 29 passengers and the crew of five. The aircraft had been taking over a service after the Boeing 707 scheduled for this flight was withdrawn. There was no warning of the disaster, and on the day following the accident no suggestion as to its cause, except that lifejackets were found on the bodies of several of the passengers, indicating that they at least might have been expecting the aircraft to ditch in the Atlantic only 12 miles away.

On the same day a BEA Viscount at Valetta, Malta, carrying 47 passengers on a flight from London, ran off Luqa's runway after landing and buried its nose in the control tower. The pilot and copilot and one passenger were injured but the rest of the passengers and crew escaped unhurt.

The third incident on this same day—it cannot fairly be classified as an accident—occurred to a United Air Lines' DC-8 making an emergency landing at Buckley Field, near Denver. It was *en route* from San Francisco to Chicago when it developed hydraulic trouble. All eight main tyres burst on landing and it ran off the runway, but none of the 88 passengers or crew was injured.

The fourth accident of the week occurred at London Airport and again a BEA Viscount was involved. As the aircraft taxied off the runway after landing the nosewheel collapsed, the front fuselage slithered along the ground and hydraulic fluid or friction started a fire in the fuselage. The 59 passengers and crew escaped without injury, but two runways were isolated by the accident until the wreckage could be examined. According to newspaper reports the Ministry of Aviation later commented that there had been "an unfortunate delay" in extinguishing the blaze; London Airport fire brigade ran out of foam as a result of difficulty in finding water hydrants in the fog which covered the airport at the time.

BREVITIES

Last Monday de Havilland delivered to BOAC the last of the 19 Comets which the corporation has on order. All deliveries were within or ahead of the limit set by the contract.

Mac.Robertson-Miller Airlines, which introduced its first Friendship into service on December 28, is contemplating the purchase of a second aircraft.

BOAC have appointed Basil Bamphlyde, general manager Eastern Routes, to the board of Middle East Airlines in Beirut. Mr Bamphlyde is also a member of the board of Malayan Airways.

New rates of pay offered to BEA pilots of Comet 4B services are now under negotiation with BALPA. The maximum rate of pay for a senior captain under the offered scale would be £4,200 a year.

Anticipating a BEA request for permission to operate helicopter services between London and Amsterdam, the Dutch Government has already said that it will consider favourably any requests that may be made.

TCA pilots flying DC-8s are to get an increase in salary of about 30 per cent above piston-engined figures. The present salary scales on the latter types range between £3,571 and £6,071 for a captain and 50 to 60 per cent of this rate for a first officer.

Silver City have applied to the ATAC for approval of a service between Leeds/Bradford and Blackpool at a fare of £2 10s return. It would start on April 10.

Appointed Swissair general manager for the UK is M. A. Keller. He replaces W. Wyler, now general manager for Western Switzerland and a member of the airline's general management

The Sperry Gyroscope Company are to supply Vickers Inc aircraft hydraulic pumps, produced under licence, for both the D.H.121 and the VC10. Orders for 72 of these FAA-approved variable delivery pumps have been received.

Karachi Airport is now due to be back in full operation after three months' work on re-surfacing the 7,500ft runway. Work on a new runway for jet traffic is scheduled to begin in March; most jets meanwhile are landing at Mauripur.

Signed at Ferihegy Airport near Budapest recently was an agreement between Malev and the Air Transport Office of China for technical co-operation and joint representation. Hopes were expressed that a service would be established between China and Hungary.

New branches of the Commonwealth Union of Trade (see *Flight*, January 8) have been opened in Nairobi and Dar-es-Salaam and Eagle charter flights to London have been arranged for January 28, February 11 and 25, March 12 and 26 and April 11 and 26.

According to H. Pearson, chief research engineer of Rolls-Royce, the initial commercial thrust of the RB.141/3 will be 14,340lb (13,980lb guaranteed minimum) for take-off with a dry weight of 3,650lb. For later delivery a take-off thrust of 15,350lb (15,000lb guaranteed minimum) is envisaged, and future developments of the RB.141 are expected to achieve 18,000lb.

We regret to record the death of Capt O. E. (Paddy) Armstrong, who died in Warwickshire on December 26. He was the first Aer Lingus pilot and operations manager when the company started operations in May 1936. Previously he had served with Capt Gordon Olley. Subsequently he was chief pilot and manager of Morton Air Services at Whitchurch before joining Cambrian Airways as a pilot.

Among the aircraft being considered by BWIA, it is reported by *Aviation Week*, is the Convair 600 and the Boeing 720.

Lufthansa's order for Boeing 720Bs is now confirmed as being for "three to five," although final details of the purchase agreement are not expected until later this month.

It is reported that Lord Douglas of Kirtleside, chairman of BEA, is to visit the US this month to open a new BEA office in Los Angeles and to examine American helicopters.

This month BOAC extended one of its twice-weekly Britannia services to Venezuela on to Bogota, Colombia. This is a 23hr journey via Bermuda, Trinidad and Caracas.

The Caravelle purchased by General Electric is to be delivered to the US on July 14. After installation of two CJ-805-23s GE will conduct installation and aerodynamic flight tests in California with what will then be the first Caravelle 7.

It is reported by *Aviation Week* that negotiations between United Air Lines and Sud-Aviation for 25 Caravelles "hit a snag" recently when UAL asked Sud to accept some DC-6Bs and DC-7s in part exchange. The French are said to be studying the proposal.

Approval has been given by the Jordan Government to a decision by the Council of the Arab League to establish an Arab United airline. All member states of the Arab League are to contribute to the company's capital of £17m.

The 100th Boeing 707 was completed by Boeing's Transport Division at Renton during the first week in January, a seven-day period in which, it is estimated, the two millionth passenger was carried in a 707. More than 80 Boeing 707s are now in service, 14 months after the type was introduced.

In 1959 nearly twice as many passengers travelled by air across the North Atlantic as travelled by sea, yet it was only in 1958 that parity was first reached. Ratios of air to sea traffic over the past two years have been: 1958: sea 950,000, air 1,292,000; 1959: sea 884,000, air 1,650,000.

During 1959 more than 4,000,000 people passed through London Airport—half a million more than used it in 1958. Actual figures were 4,042,600 last year compared with 3,555,000 the year before. The number of aircraft movements, however, dropped from 129,500 to 127,000, a reflection of the increased unit capacity of the big jets.

Another DC-8 has been ordered by Japan Air Lines, bringing the total order to five. Delivery of the first aircraft is expected in June. The airline say that they are planning a thrice-weekly round-the-world jet service for 1963, for which they would require ten big jets and might enter an association with Air Union, SAS, PanAm or BOAC.

Aeroflot have introduced Il-18s on the service from Moscow to Bucharest and Sofia. Il-18s are also to be introduced on to the Berlin - Moscow service by East German Lufthansa from April 1960 and Aeroflot Tu-114s will be introduced on to many domestic long-range routes during the spring of 1960, including Moscow to Vladivostok.

Pakistan International Airlines are planning to lease from Pan American a Boeing 707-120 for use on its Karachi - London route. These terms are said to involve payment to PanAm of about $50,000 per round trip. A thrice-weekly service would start in the spring, and Pan American would operate the aircraft until Pakistani pilots are trained. Maintenance costs would be borne by PIA.

In addition to the five F.27 Friendships ordered from Fokker by Türk Hava Yollari, the Turkish national airline have placed an order for an additional five with Fairchild, bringing their total order to ten. All will be powered with Rolls-Royce Dart RDa.6s and not, as speculatively stated in "The Airlines' Shopping List" (*Flight*, page 56, last week), with Dart RDa.7s. Negotiations for the purchase were concluded on December 23: the unusual nature of the order—Fokker and Fairchild Friendships differ substantially in detail—is understood to be the result of favourable financial arrangements negotiated with the US and Holland.

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